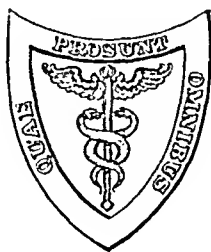


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A. O. J. KELLY, M.D.

NEW SERIES

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~~UN~~MEDICAL

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THE
AMERICAN JOURNAL
OF THE MEDICAL SCIENCES.

JULY, 1910.

ORIGINAL ARTICLES.

THE VALUE OF OPTIMISM IN MEDICINE.¹

BY E. L. TRUDEAU, M.D.,

SARANAC LAKE, NEW YORK.

I HAVE been sorely puzzled in the selection of a topic for my address to you tonight. I preferred not to impose on a general Congress of Physicians and Surgeons a subject relating to my own specialty; I had not confidence enough in my powers, and too much consideration for you to attempt a more or less ambitious and comprehensive historical review of the advances, achievements, and possibilities of medical science, so that I finally decided simply to look back on the personal experiences of my own medical life and select from them some topic on which to say a few words to you.

As I look back on my medical life, the one thing that seems to stand out as having been most helpful to me, and which has enabled me more than anything else to accomplish whatever I have been able to do, seems to me to have been that I was ever possessed of a large fund of optimism; indeed, at times optimism was about the only resource I had left with which to face most unfavorable conditions and overcome serious obstacles; and it is, therefore, on the value of optimism in medicine that I want to speak to you tonight.

Optimism is a product of a man's heart rather than of his head; of his emotions rather than of his reason; and on that account is

¹ The president's address at the Eighth Congress of American Physicians and Surgeons, held in Washington, May 2, 1910.

rather frowned upon by many physicians whose scientific training naturally leads them to depend solely upon the qualities of the intellect, and look with suspicion upon any product of the emotions. We doctors are too apt to look upon "brains"—that is, a man's purely intellectual attainments—as the criterion of his chances for achievement in life, and to ignore and even deprecate those qualities which are closely related to his emotions as rather likely to mislead and hamper him in his career. And yet optimism is a prominent factor in anything a man may achieve in life. It is a mixture of faith and imagination, and from it springs the vision which leads him from the beaten paths, urges him to effort when obstacles block the way, and carries him finally to achievement, where pessimism can see only failure ahead. Optimism means energy, hardships, and achievement; pessimism, apathy, ease, and inaction. Optimism may and often does point to a road that is hard to travel, or to one that leads nowhere; but pessimism points to no road at all.

I have come in contact with many men of splendid attainments and opportunities who, by habit and education, have suppressed imagination and faith until their usefulness has been greatly impaired, and who accomplished little in life because the chill of pessimism ran in their blood, and the "qui bono" was the early deathblow to every impulse at accomplishment. Lack of faith and imagination has quenched achievement in many men whose intellectual attainments promised most fruitful careers.

It is, perhaps, true that the great majority of physicians, outwardly at least, appear to incline neither to pessimism nor optimism, and seem merely to float with the tide, without aspirations or ideals; but in reality few of them, in the innermost recesses of their ego, are entirely free from some degree of imagination and faith which they habitually quench, and which, if cultivated, would at least broaden the sphere of their activities and make life less colorless.

The doctor, whether he be a scientist and his life wholly given to scientific investigation in a laboratory, where reason and intellect reign supreme, or whether he be wholly a practising physician and surgeon in daily contact with suffering humanity in its struggle with disease, will need all the optimism he can cultivate if his life is to be as fruitful in results as it can be made. The scientist without optimism may be an admirable intellectual machine, who, it is true, is not likely to be led astray from the well-worn road of demonstrable and generally already demonstrated facts, and as such he will have his place in life; but he will never climb above the ruck, he will create and achieve little in the field of original research, unless faith in his own powers furnishes the incentive to constant effort and imagination leads him into an unexplored region to new methods and untried lines of investigation.

The professor of medicine and the laboratory director need

optimism if they are to inspire their students to do their best work, and they should beware how they quench, too often unfortunately with ridicule, the optimism of the young men who look to them for direction. Over-enthusiasm is not a very serious fault in a young man, and can easily be kept within bounds, and optimism in a student is a better incentive to work than pessimism.

The practising physician and surgeon must have optimism if he is to develop a full degree of efficiency in meeting the terrible emergencies of acute illnesses and accidents, or the long drawn out struggle with lingering and hopeless disease, and at the same time inspire his patients with a degree of optimism which means everything to them in the ordeals they have to pass through. To the practising physician and surgeon optimism is even more necessary than to the scientist, for besides moulding the doctor's character and guiding him in his decisions as to the case, his optimism is at once reflected to the patient and influences his condition accordingly. How great this influence may be we are learning more and more to appreciate. In his hour of need the patient has no means of judging of the physician's intellectual attainments; it is the faith that radiates from the doctor's personality that he seizes upon and that is helpful to him. Any encouragement that emanates from the physician will help keep up the patient's courage and carry him through long days of illness and suffering to recovery; and, where recovery is impossible, if the doctor's optimism—that is, his faith—is of the kind that extends to the future, not only here but hereafter, it may dispel for the patient much of the darkness and despair which brood over the end of life, and perhaps even illumine for him that vast forever, otherwise so shrouded in impenetrable gloom.

Ian Maclaren's optimism was of this kind, and Dr. Grenfell's optimism is every day helping him to heal not only the sick bodies, but the broken spirits of men as well. This is the highest type of optimism the doctor may attain to, as its influence may reach not only to the physical, the intellectual, and the psychical, but even to that dim ethereal region of the spiritual, from which spring man's most sacred and cherished aspirations. This side of the doctor's life of service to humanity is known but to himself and to those who in the hour of death have turned to him for help; to the world this is a closed book, but what is written in its pages has helped to make the medical profession a benediction to mankind.

Perhaps the most brilliant and striking examples in our time of the value of optimism, each representing one of the two extremes of the medical profession—that is, experimental science and practical medicine and surgery—are Pasteur and Grenfell. I have chosen these two men as examples of optimism, each in his own sphere, because, widely different as have been their fields of labor, they each represent a type of optimism in medicine which, to a greater

or less degree, is the ideal of so many doctors' lives—the humanitarian type. The moving force in both Pasteur's and Grenfell's lives has been the relief of human suffering, and their intellectual attainments have been consecrated to this end. Personal ambition, the pride of intellect, or the love of fame has had little or no influence in urging them to their great achievements.

The man who, standing at the very threshold of the discovery of the germ origin of disease, did not hesitate to say, "It is within the power of man to cause all infectious diseases to disappear from the earth," must indeed have been an optimist. Pasteur's optimism led him unerringly to the solution of every experimental problem he started to solve, because his faith made him see nothing ahead but success, and his imagination led him to a solution of the most difficult problems when his reason alone would have failed. His hydrophobia work is a striking example of this. Who but an optimist would not have been discouraged at his repeated failures to find the specific microbe of hydrophobia which, in the light of all previous knowledge, was the first requisite to success in evolving a method of immunization? His faith saw in this no cause for discouragement, but only urged him to renewed effort, while his imagination led him to leave the usual methods, ignore the microbe, and search for the seat of the poison in the rabid animal; and when he had located this in the medulla, and not in the saliva alone, as hitherto believed, devise a method whereby the toxic medullas could be attenuated and transformed into a vaccine of graded virulence. But of what practical use would a vaccine be that had to be applied before the individual was bitten? No vaccine applied *after infection* had up to that time ever been found to be successful. That Pasteur was an optimist and had a vision is shown by his own words in April, 1884: "What I aspire to is treating a man after a bite with no fear of accident." And you all know that his vision became a reality, and that practically the conquest of this most dread disease is an accomplished fact.

The moving force in the great medical humanitarian achievements of Dr. Grenfell is the highest type of optimism; a faith which includes not only that which is seen and temporal, but the unseen and eternal as well; and on this, which to the pessimist would seem an uncertain and emotional basis, he has built up a work which has arrested the attention and won the admiration of the civilized world. That kind of optimism which extends to the hereafter is in Dr. Grenfell no mere idealist's vision, but a very real force to be reckoned with in this world if it enables a man in so few years to accomplish what he had done. It has enabled him in the face of constant and imminent dangers by land and by sea to bring skilled medical and surgical treatment to a suffering and helpless community; single handed, without modern aids and appliances, to perform delicate and difficult surgical operations under most

unfavorable conditions; to throttle entrenched vice in its stronghold and east it out; to turn aggregations of squalid huts and drunken, poverty stricken, and despairing people into thriving, well-ordered, and productive communities. Had Dr. Grenfell lacked an inexhaustible fund of optimism, had that faith in God and man, which to him is the most present reality in life, not been his, had he believed only in "that which could be reduced to a formula," had the "knowable" been for him the "only real," in spite of his intellectual attainments the world would have lost the inspiration of his matchless career, and the inhabitants of the Labrador coast would have remained plunged in the gloom of degradation, despair, and misery.

It is to this high type of optimism that we owe, through the untiring labors of Richard Cabot, the social service department of the tuberculosis dispensary. The success of Dr. Cabot's work has been due primarily to his own personality, which so strongly reflects his faith and his ideals, and which has inspired those whose efforts he directs. This new departure in medical work is not scientific in its character, but Christian and humanitarian. It is being taken up as a regular part of every modern dispensary and hospital, and extended to relief measures among children, chronic invalids, and convalescents, and promises in time to revolutionize the whole character of hospital and dispensary methods. The degree of its success will always greatly depend, however, on the personal faith and enthusiasm of the physician as communicated to those who work under his direction. The far-reaching possibilities of this new departure in humanitarian medicine may be gathered from the following sentence taken from a recent address of Dr. Milton J. Rosenau: "The object of preventive medicine is, perhaps, not so much to save as to prolong life, and there is no use in prolonging life unless we can make healthier, better, cleaner, happier lives."

If there is no room for pessimism in the doctor's individual career there is no room for pessimism in our profession, for its ideals and the goal toward which it is moving so rapidly are pregnant with optimism. The conquest of disease by prevention, though disease is the source of the doctor's livelihood, the placing ever at the disposal of the poor, without money and without price, the greatest gifts of learning and skill at our command, the strangling of deception and quackery in our midst by education of the people, are standards which can only be inaugurated and upheld by the highest type of optimism.

Optimism is the one thing that is within the reach of us all, no matter how meagre our intellectual equipment, how unpromising our outlook at the start, or how obscure and limited our careers may be. It was about my only asset when I built my first little sanitarium cottage on a remote hillside in an uninhabited and

inaccessible region. Viewed from the pessimist's standpoint, that little cottage as an instrument of any importance in the warfare against tuberculosis must have appeared as a most absurd and monumental folly. Optimism made me indifferent to neglect and opposition and blind to obstacles of all kinds during the long years of struggle before the value of sanitarium treatment became generally recognized. It enabled me to undertake the culture of the tubercle bacillus and delve in the complex problems of infection and artificial immunization, though I had no knowledge whatever of bacteriology, no laboratory, no apparatus or books. It has steadily upheld my faith in the possibility of ultimately attaining to an immunizing treatment for tuberculosis in spite of many discouragements and years of fruitless work.

Optimism enabled me to assume for over a quarter of a century the financial support of my work, and though the little cottage grew to be a village, and the workroom in my house became a well-equipped laboratory, though their support each year required large and increasing sums these have ever been forthcoming.

In a long life which has been lived daily in contact with patients beyond the reach of human skill, who through months and even years of hopeless illness looked to me for help, I have indeed had need of all the optimism I could cling to. It has ever been a precious asset to me, and I hope to those about me as well, and has never entirely failed me.

Let us not, therefore, quench the faith nor turn from the vision which, whether we own it or not, we carry, as Stevenson's lantern bearers their lanterns, hidden from the outer world, and, thus inspired, many will reach the goal; and if for most of us our achievements inevitably must fall short of our ideals, if when age and infirmity overtake us "we come not within sight of the castle of our dreams," nevertheless all will be well with us; for, as Stevenson tells us rightly, "to travel *hopefully* is better than to arrive, and the true success is in labor."

THE TREATMENT OF ARTERIAL HYPERTENSION.

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ALTHOUGH encountered in a variety of diseased conditions not primarily vascular in character, high blood pressure is most frequent in association with arteriosclerosis and chronic nephritis. It plays a leading role in the clinical history of these two diseases, especially the latter, and furnishes so preponderant a share of the

subjective discomforts as frequently to constitute an urgent indication for treatment. The inveteracy of this development bears a much more intimate connection with the element of toxemia than with the degree of arterial degeneration. Were this not the case we would expect to encounter the highest pressure readings in senile calcification of the arteries. For the same reason we might anticipate higher pressure values in arteriosclerosis than in chronic nephritis, because of the more essentially vascular character of the former disease. This is against the rule in both instances. In chronic nephritis we meet with the highest pressures observed and the more toxic the case the more pronounced and inveterate is the element of hypertension. Uremia furnishes the most extreme excursions above the normal. In cases in which the inroads of disease have rendered the kidneys unable to depurate the system, and when collateral channels cannot be sufficiently invoked to offset the renal deficit it will be found impossible by any means at our command materially to influence the resulting hypertension. In actual practice it will be found that the cases displaying the most irregular blood-pressure are those in which the toxic factor prevails. What the pressor toxins are we have as yet no clear view, but the general contention is that they consist of certain abnormal bio-chemical products. Clinical experience furnishes us with many suggestive hints pointing to the intestinal tract as one at least of the sources from which pressor toxins originate.

In arterial hypertension the heart is the organ that bears the brunt of the circulatory disturbance. In the early stages of hypertension the muscular part of the arterial wall hypertrophies in response to extra work (hypermyotrophy). At this stage the vessel is still elastic, though thickened and hypertonic, and nitrites will successfully lower blood pressure. As the process advances degenerative changes more and more destroy the muscular tissue and vasomotor response progressively diminishes until the nitrites may totally fail to lower blood pressure. Peripheral resistance increases in this manner with the stage of the disease. At first under the influence of the same causes as affect the arteries, and with the added burden of furnishing to the tissues an adequate fluid interchange, the myocardium thickens just as does the myarterium. Both the heart and arteries hypertrophy together. Finally as the disease advances the limit of the heart to increase further its functional area is reached, the cardiac and arterial hypertrophy no longer run parallel, but enter into conflict (Ewart). The arteries continue to thicken and stiffen, the heart wall to thin. The stage of heart failure has begun. The sequence of events occurring in the heart are first hypertrophy and finally dilatation in the face of continued overstrain. The clinical events at this stage are those which characterize progressive heart failure. The secondaries and complications of prolonged hypertension will be determined by the relative ability of the various organs to endure

the excessive strain. On the part of the heart we observe hypostole and asystole, of the kidneys albuminuria and uremia, of the arteries atheroma. A cerebral vessel may give way and apoplexy close the scene. How long the final breakdown may be postponed will depend on the inherent vitality of the vascular tissues and the care and circumspection with which the patient treads his way amongst the pitfalls that beset his path.

The treatment of arterial hypertension constitutes a problem of much interest. High blood pressure being essentially no more than a vascular reaction against the presence of toxins in the circulating blood, the primary indication is detoxication. To accomplish this purpose we are forced to depend on the regulation of the diet and general hygiene and stimulation of the various emunctories.

The dietetic control of hypertension is too often interpreted as a simple restriction of flesh food. Excess of meat proteins unquestionably is harmful in this condition and on principle the diet should embody a strict regulation in this particular. We should, however, not rest with simple qualitative measures of this kind. Individualization is as necessary and important in this matter as in the application of any other therapy. The stage of the disease and the physical type of patient must be given due weight. To enforce a non-nitrogenous dietary does not exhaust the indications in any large percentage of cases. To place a strict embargo against meats and then permit a patient with high tension unlimited indulgence in other varieties of food is to invite failure. Even in health such a procedure with the average adult leads to excessive intake, lack of satisfaction, increase in weight with impairment of vigor. Digestive plethora whether of carbonaceous or protein food elements is harmful. Less toxemia will result and certainly less work be required of the organism to appropriate its quota of nitrogen from flesh than from vegetable proteins. A certain concession in the direction of meats may be allowed, especially in non-nephritic cases, the midday meal being chosen for the meat ration and its quantity limited within physiological bounds. The activities of the individual may to an extent govern the quantity permitted. Quantitative limitation should to a large extent take the place of qualitative restriction, moderation in all directions being enjoined. High pressure cases largely conform to the corpulent sedentary type and an all-round reduction in food intake is indicated. The proper diet in such cases will result in a reduction in weight coincidently with a reduction in pressure. For clinical purposes it is necessary to take note of that group of hypertension patients who eat moderately, but whose intestinal processes are faulty and who consequently may become toxemic on relatively spare rations. It is necessary here to gauge carefully the digestive capacity and let this factor rather than theoretical qualitative considerations dictate the food list. The weighing scales may very wisely be consulted to point the result of our dietary control.

Corpulent individuals should lose gradually in weight, spare nervous patients should at least not be reduced, but rather should gain somewhat in weight. Above all we should not tamper with the diet to so great an extent as to undermine the strength of our patients, nor by too great particularity in our restrictions engender morbid tendencies toward food.

The most harmful combination in plethoric cases of hypertension is constituted by the indulgence of the appetite, which is usually excellent, and physical indolence. This is shown in practical clinical observation by the Monday morning rise in blood pressure resulting from the inactivity of Sunday with the increased intake of a more luxurious fare on that day. An excess of twenty points or more above the usual average is often noted on Monday morning. Flatulency is a prominent symptom and hypertensive crises frequently coincide with tympany and belching. Bilious symptoms often initiate cardiac distress, palpitation, and angina. The diet should as far as possible be directed to control the intestinal fermentation. An all-round quantitative reduction of food intake will be found to accomplish this much better than qualitative measures alone. At any time during the course of a case we may be called upon to meet the emergency of an acute increase above the usual average pressure reading. Very suddenly and often without apparent explanation 40 or 50 mm. may be added to a pressure already abnormally high. At such times the heart may falter and apoplexy prodromes appear. In nephritic cases these sudden increments are usually uremic in origin. During such hypertensive crises a period of starvation and restriction of fluids may become advisable, or we may with advantage follow the suggestion of Haig and enforce for the term of such increase a diet consisting solely of bread and fruit.

The foregoing dietetic considerations apply to sthenic cases during the period of cardiac stability. When dilatation has supervened and symptoms of cardiac incompetency become pronounced increasing difficulty will be encountered in furnishing a diet suitable to the control of toxemia and digestive discomfort. The procedure must follow the indications of expediency and the problem be solved on an individual basis along the lines which govern the hygiene of cardiac invalids generally. The advent of secondary low blood pressure with its invariable vicious abdominal circle will mark the failure of all dietetic endeavor, assimilation being so badly impaired as to defeat all efforts aimed at digestive control.

At the outset the patient should be taught to avoid the use of salt on the food after it is cooked. This is a measure of possible utility in controlling tension and by inaugurating the practice early in the case the patient is prepared for the later stages of his malady when salt restriction becomes imperative. Restriction of fluid intake is a matter of small importance during the stage of cardiac competency. Even the generous imbibition of water during this phase of the case

does not suffice materially to raise the blood pressure and a distinct advantage to elimination is gained by abundance of fluids. Later on when the heart begins to fail it is but common sense to restrict within moderate limits the fluid intake.

Not only should the diet be made the subject of exact instruction to the patient, but also every detail of importance in the personal hygiene: the exercise, hours of work, care of the bowels, clothing, baths, etc. A grave mistake is made if we interfere too greatly with these patient's activity. The hours of work should be regulated within moderate bounds so as to avoid overstrain and reduce within safe limits nervous wear and tear. Exercise in the open air is absolutely essential. Overstrain, sudden exertion, and over-fatigue being unquestionably harmful are to be emphatically interdicted. Although the primary effect of exertion is to elevate the systolic reading, this increase is transient and is followed by a subsidence of pressure to the original level or even an eventual slight diminution. Cardiac fatigue lowers blood pressure and quickens the pulse. Sudden severe exertion and excessive fatigue are fraught with danger. Walking, golf, sailing and rowing constitute the best forms of exercise for these subjects. When circumstances permit the patient should seek climatic conditions which will permit of such moderate out-of-door activities during the different seasons.

Many kinds of baths have been advocated for the reduction of blood pressure. The procedure usually employed consists of heat to produce diaphoresis, either by means of the electric light or hot air cabinet followed by Scotch douche, Scotch rub, friction, etc. The immediate effect of these measures is to produce a drop of from ten to twenty points in the systolic reading. This reduction proves very transient in the majority of instances, the blood pressure quickly returning to the former level. The blood pressure chart may not appear to be greatly influenced by hydrotherapeutic measures and yet it will frequently be found that the symptoms seem much improved by the treatment. The same thing is true of simple sweat baths. The routine employment of sweating twice or thrice weekly is often found of decided benefit. Although they may not materially lower the blood pressure they apparently aid in preventing the sudden increments which result in discomfort and danger to the patient.

Perhaps the best single measure in the hygiene of hypertension is the morning purge. "Dickinson's morning purge" has had a recognized vogue for many years in granular kidney. Each morning before breakfast a sufficient dose of some saline laxative or aperient water should be administered. It serves the double purpose of elimination and depletion. I confess to a preference for Glauber's salt in these cases. Two or three free watery evacuations daily should be secured. In addition to this measure blue mass or calomel may with advantage be given once every week or ten days as a detoxicant.

A point at present in dispute is the propriety of employing vasodilator drugs for the regulation of high blood pressure. Under the authority of Krehl and Janeway the view has been advanced that high blood pressure is a compensatory process. Janeway says "whatever the exact method of its production we cannot avoid the conclusion that the hypertension expresses an attempt of the organism to maintain an adequate speed of capillary flow through the kidney or other organ which would be impossible without it."

As a result of the promulgation of such views drug control of hypertension has come to be regarded in many quarters as a tampering with nature, hence unscientific. This ultraconservative stand has undoubtedly served a good purpose by restraining somewhat the ardor of those who would have carried on too vigorous a campaign against this symptom. Attractive as this theory appears, and perhaps applicable to cases of contracted kidney, it fails to satisfy when applied to that large class of cases in which no renal disease exists and yet excessive pressure values obtain. As a matter of fact, there is no certain correspondence between the amount of urine excreted and the degree of blood pressure. This is true in health and also in hypertension cases.¹ The administration of a nitrite to lower blood pressure will as often be attended by an increase as by a fall in the amount of urine (Leech). Hare takes his stand against drug regulation of high pressure on the ground that the tissues have become accustomed to a new standard of pressure with which it is unwarrantable to interfere. There is undoubtedly much truth in what he says and the wise physician will not meddle too much with the *status quo*. If he is not guided by a wise conservatism in the administration of vasodilators, the physician may be chagrined to find his patient more disturbed and vastly more uncomfortable with the pressure lowered than he was before. This is, however, no fault of the drug, but of the way it was employed. Properly exhibited I believe that a certain measure of vascular drug therapy is applicable to these cases and with the greatest benefit.

It goes without saying that in so far as high pressure is dependent on anatomical changes in the vessel walls no influence can be exerted by drugs. If we administer $\frac{1}{100}$ grain of nitroglycerin to a patient with a pressure of 200 mm., we will often obtain a drop of 20 to 30 points. It is obvious that the high pressure in this patient is not wholly due to anatomical changes, but that there is as well a certain spastic condition of the vessels which has been relaxed by the nitrite. This corresponds to the hypertonus of Russel and represents at the moment the irritative effects of circulating toxins. It is this spastic contraction of the vessels that causes much of the functional distress of these sufferers and is to blame for the irregularities of the blood pressure chart.

¹ Jour. Amer. Med. Assoc., April 13, 1907, p. 1247.

It may well become the object of treatment for it apparently serves no good purpose to the organism, but on the contrary endangers the integrity of the vessels and subjects the heart to overstrain. In the nitrites and iodides we possess the means of relieving to some extent this vicious element. I am far from advocating the use of vasodilators in all cases.

When the pressure lies within moderate bounds and there are no subjective symptoms nor physical signs of disquieting character, no active interference with drugs is necessary. The higher above 200 mm. the pressure rises the nearer impends the inevitable breakdown of heart or artery, and we should proceed to estimate what advantage we may secure by vasodilator medication. We have two important points to determine as a preliminary before initiating a course of vascular drug therapy. One of these is the degree to which vasomotor response is retained by the arteries and the other is the functional adequacy of the heart muscle. Following the suggestion of Oliver, we may secure a rough estimate of the arterial response by administering $\frac{1}{100}$ grain of nitroglycerin and carefully noting its effect on systolic pressure for at least one half hour. The reduction secured by the nitroglycerin will afford a rough index of what may finally be accomplished by routine vascular medication. Should no response or but a trifling one attend the action of the nitroglycerin, it will generally speaking prove a futile undertaking to inaugurate vasodilator treatment. This preliminary trial with nitroglycerin should be undertaken with some caution in patients who have not previously experienced its action. It is better to give it in several fractional doses at short intervals instead of in one dose. If this precaution is not observed patients may now and then develop syncope or severe circulatory depression. This happened to me recently, when an elderly lady to whom $\frac{1}{100}$ grain of nitro-glycerin was administered developed every evidence of shock, lost consciousness, and did not recover vascular tone for one-half hour.

If the blood-pressure range is excessive and especially if observations indicate the presence of vascular spasm nitrites may be begun. The nitrite best suited for routine use is sodium nitrite. Its action is sufficiently prolonged to qualify it for this purpose and its administration is not attended by the disagreeable cerebral discomforts that frequently follow more active vaso-dilators (nitroglycerin, erythrol-tetranitrate). It may be begun in doses ranging from one-half to three grains at intervals of from two to six hours depending on the severity of symptoms. It should be invariably begun in the smallest dosage and gradually increased until the effect desired is produced, or its failure demonstrated. Its therapeutic action can often be observed in the blood pressure chart, but not always. A certain proportion of cases show a reduction of from 10 to 15 per cent. in the average blood pressure range and along with this reduction experience a sensible relief of symptoms. Not infrequently the blood pressure

chart may show no reduction and even at times a slight rise in average pressures. We are not to conclude from this that the drug is inoperative, for such patients occasionally will testify that their cardiac irritability, dyspnoea, or cerebral discomforts have undergone a distinct amelioration. Such individuals may be considered favorable subjects for nitrite therapy. A certain proportion of patients are distinctly worse under nitrite therapy. This is almost always the case in the hypertension of Bright's disease. Nitrites often cause a marked fluctuation without reduction in the average pressures, but with the effect of markedly aggravating cardiac and cerebral distress. Such cases are unsuitable for vaso-dilator medication. As a general rule nitrites should not be employed in Bright's disease except to meet emergencies.

For routine use in favorable cases the following combination, originally suggested by Brunton, will be found excellent: Sodium nitrite, 2 to 3 grains; potassium nitrate, 10 grains; potassium bicarbonate, 10 grains. To be taken in hot water three times a day after meals. Spiritus ætheris nitrosi in teaspoonful doses, several times daily, will often be found sufficient to modify the discomforts of high pressure.

The employment of the iodides coincidently with nitrite medication will at times be found to improve arterial response. In cases characterized by advanced arterial degeneration and impaired vasomotor tone iodides are indicated rather than nitrites and should be given in a routine manner for long periods.

The fact that the case is one of hypertension does not necessarily imply that we must confine our efforts to the relief of the vascular condition. It is often quite as essential to support the heart. We are frequently appraised of the existence of ventricular inadequacy, especially in long-standing cases of hypertension, by the existence of œdema, gallop rhythm, or the occurrence of attacks of acute dyspnoea. With or without such indications to guide us it will often become advisable to resort to some method for the estimation of the heart reserve. A rough and ready clinical means for estimating the functional power of the heart is Graüpnér's test. This test rests upon the fact that the work reaction of weakened hearts after a measured amount of exertion differs from that of normal hearts. Graüpnér used a weight and pulley ergometer. A measured amount of stair climbing may be made to answer equally well. The number of foot pounds of work is reckoned by multiplying the body weight in pounds by the number of stairsteps climbed. Graüpnér describes the reaction in normal hearts (normal Erholung) as follows: after the pulse rate has risen as the result of exertion and again fallen to normal which happens quickly in healthy subjects, the systolic blood pressure begins to rise reaching its maximum some minutes later than the pulse rate, gradually falling thereafter to or sometimes below the original level. In weakened hearts if the damage is but

slight the reaction of the blood pressure still occurs, but is delayed and perhaps diminished in degree. In seriously weakened hearts there may be no reaction whatever, the blood pressure declining from the start, then gradually reascending to the usual level. According to my experience the usual reaction, on the part of the blood pressure is an immediate rise of from 20 to 40 mm., coincident with the increase in pulse rate. Almost at once the pressure begins to fall again and in from ten to twenty minutes has reached its former level. In seriously weakened hearts this primary rise of pressure is but slight, usually a few degrees only, and is almost immediately followed by a decline which progresses until the pressure may register

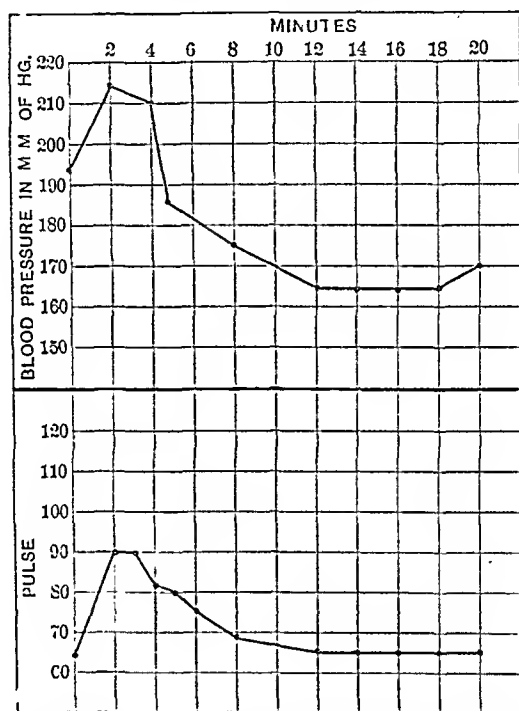


FIG. 1.—C. B., aged sixty years. Heart much enlarged; systolic mitral murmur; weak ventricle. Work=8600 foot-pounds in three minutes.

30 mm. or more below the original point (Figs. 1, 2 and 3), the pulse increasing in frequency and perhaps becoming unsteady as the blood pressure falls. This type of reaction may be interpreted as showing the ventricle first reacting but proving unequal to the task of maintaining pressure with a compensatory increase in pulse rate.

Although Graüpnier's method is of unquestionable value in assisting us to a better demonstration of muscular insufficiency my experience would lead me to interpret the findings secured thereby, in a liberal rather than a literal manner. A negative finding has not the same value as a positive one. Quite recently I elicited a pretty satisfactory reaction from an old gentleman with hypertension

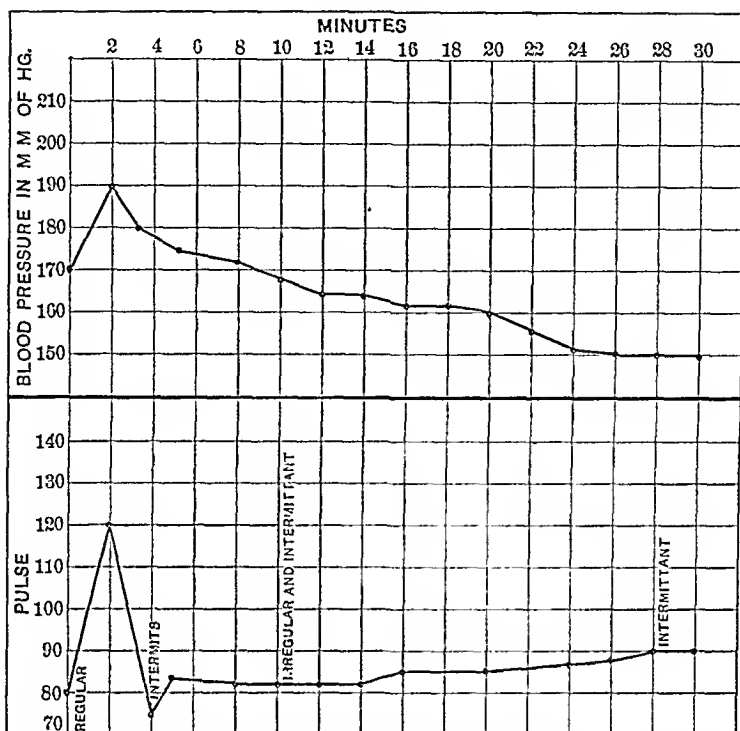


FIG. 2.—G. H., aged sixty-nine years. Myocarditis with a weak ventricle.
Work=9600 foot-pounds in three minutes.

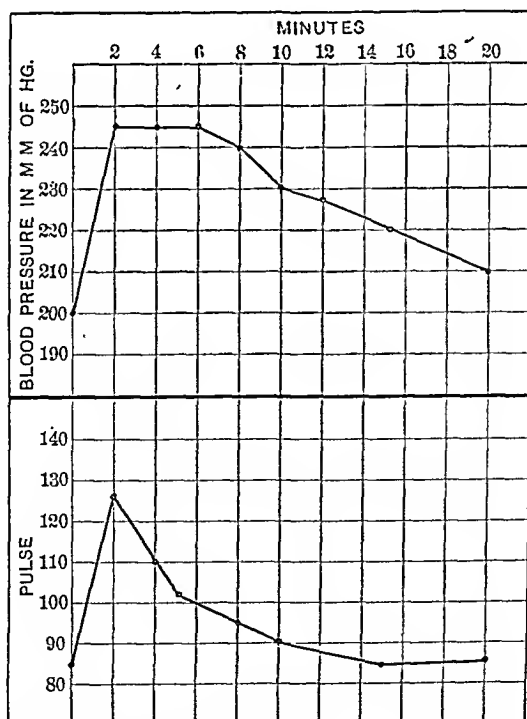


FIG. 3.—Mrs. W. K., aged seventy-eight years. Osteosclerosis; myocarditis;
relative mitral leak; Work=2500 foot-pounds in three minutes.

yet notwithstanding he died within a fortnight of asystole (Fig. 4). The greatest caution should be exercised in the administration of nitrites in cases displaying indications of ventricular weakness. The effect of nitrite therapy in this type of case is often to produce rapid heart action, depression, and dyspnoea. If administered at all nitrites should be given very guardedly in conjunction with cardiac tonics.

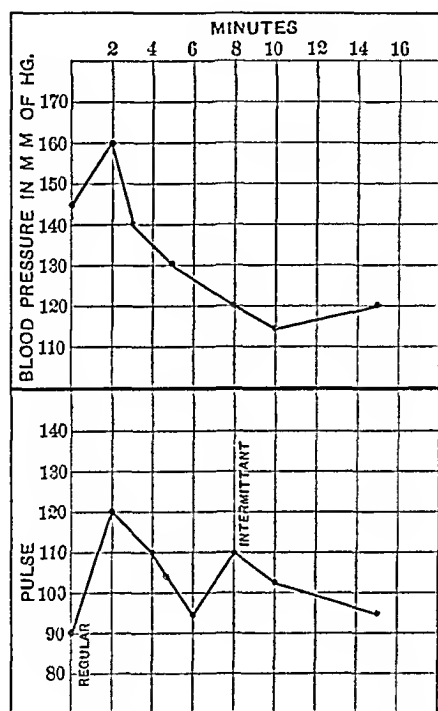


FIG. 4.—S. F., aged seventy-six years. Hypertension; heart greatly enlarged; mitral murmur. Work=15,000 foot-pounds in four minutes.

When the indications point to cardiac insufficiency the greatest emphasis should be placed on the dangers of over-exertion, and cardiac tonics may be cautiously introduced. Because the case is a high pressure one need not deter one from using digitalis, as it is rare that in physiological doses this drug increases pressure sufficiently to endanger the vessel wall. On the contrary, it is not rare to note a fall in blood pressure under digitalis, probably because the drug by improving pulmonary circulation procures better oxygenation of the blood.

THE HEMORRHAGIC DISEASE OF THE NEWBORN, WITH SPECIAL REFERENCE TO BLOOD COAGULATION AND SERUM TREATMENT.

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THE object of the present communication is to draw attention to the little recognized, clinically important fact of delayed or lost coagulation in the hemorrhagic disease of the newborn, and to discuss this in the light of recent investigations on the physiology and pathology of blood clotting. Two cases will first be briefly described.

CASE I.—*Multiple hemorrhages; total failure of blood coagulation; transfusion.* D. G., male, eleven days old. Mother's history: Fourth pregnancy; first two resulted in miscarriages, one at four months, one at two months, third child is alive and well. Mother has just been operated upon for abscess of the breast. There are no bleeders in the family. The father denies syphilis. Child was born at full term; normal delivery; breast fed; well until the seventh day, when it began to vomit after feeding. The vomitus was black. On the eighth and ninth day this vomiting continued and the stools were loose and bloody. For the past two days there has been bleeding from the nose and mouth.

Physical examination, September 11, 1908. General condition fair. Bleeding from the mouth. Skin moderately icteric. Ecchymosis over the lumbar spine. Spleen palpable one finger's breadth below the free border of the ribs. The liver not enlarged. Slight enlargement of all the lymph nodes. Temperature, 99° F.

September 12. The child was admitted to Dr. Koplik's service in Mount Sinai Hospital. At 4 P.M. an injection of 10 c.c. of horse serum was given and the coagulation time of the blood was estimated. In taking the coagulation time a modification of Milian's method was used. A drop of blood 5 mm. in diameter was taken on a cover slip from a prick in the finger. The slip was inverted on a hollow ground slide and ringed with albolene to prevent evaporation and exclude air currents.¹ With this method the moment of coagulation can be accurately determined by the failure of the drop to sag when the slide is tilted.² Drops of the child's blood taken in this way were kept for four days and showed no sign of coagulation. Experiments done with the blood at this time will be described below.

¹ The tests were done at room temperature. In the cases here described this was accurate enough. But when careful comparative measurements of coagulation time are necessary a constant temperature is, of course, extremely important. See Addis, Quarterly Journal of Experimental Physiology, 1908, vol. i, No. 4.

² Hinman and Sladen, Johns Hopkins Med. Bulletin, 1907.

The injection of serum had no effect either on the coagulation time or the hemorrhages. The child's condition became worse and a transfusion was determined upon. The father, for reasons which need not be considered here, was chosen as the donor.

Four or five hours before the transfusion, which was performed by Dr. A. A. Berg, the blood examination showed: Red blood cells, 2,800,000; hemoglobin, 45 per cent.; white blood cells, 27,600; polynuclear cells, 41 per cent.; mononuclear cells, 59 per cent.

Bleeding from the mouth continued up to the time of the transfusion, when the hemoglobin was 30 per cent. As the child received blood the hemorrhage immediately stopped. During the course of twelve minutes the hemoglobin rose from 30 per cent. to 90 per cent. and the child, which at first had been of a waxy pallor, became red and then extremely cyanotic. The transfusion was then discontinued. Blood obtained from the child just before the transfusion failed to clot at all. At the end of the transfusion the child's coagulation time was the same as that of the father's—three and one-half minutes.

September 13. Twelve hours after the transfusion the general condition was very good; temperature, 99°; no bleeding; stools still tarry, probably due to admixture of blood from the previous day. Blood examination: Hemoglobin, 99 per cent.; red blood cells, 7,860,000; white blood cells, 24,200; polynuclear, 46 per cent.; mononuclear, 54 per cent.; coagulation time, three and three-quarters minutes.

September 14. The condition was unchanged. There was no fever, and no hemorrhages. The stools did not contain any blood. Blood examination: Hemoglobin, 95 per cent.; red blood cells, 5,660,000; white blood cells, 10,000; polynuclear neutrophile, 50 per cent.; polynuclear eosinophile, 2 per cent.; polynuclear basophile, 1 per cent.; mononuclear, 47 per cent.

September 15. Temperature was 101°. There was a purulent discharge from the left ear, but no hemorrhages. Blood examination: Hemoglobin, 110 per cent.; red blood cells, 6,350,000; polynuclear neutrophile, 55 per cent.; polynuclear eosinophile, 1 per cent.; mononuclear, 44 per cent.; coagulation time, seven minutes.

The urine was collected and measured for forty-eight hours following the transfusion.

Date.	Diet.	Volume.	Sp. gr.	Total nitrogen.	Ammonia nitrogen.	Uric acid nitrogen.
Sept. 14	Breast milk, 10 oz. Water, 1 oz. (330 c.c.)	54 c.c. 16.5% of intake	1012	0.7	0.07 10% of T. N.	0.173 24.2% of T. N.
Sept. 15	Breast milk, 7½ oz. Water, 8 oz. (450 c.c.)	175 c.c. 38.8% of intake	1001	0.42	.....	0.107 25.5% of T. N.

There was considerable serum albumin in the urine. Sugar reaction was negative. Microscopic examination showed ammonium urate and a few uric acid crystals. The quantity was somewhat diminished as compared with figures given by Shiff,³ Camerer,⁴ and Reussing,⁵ who state that 62 to 68 per cent. of the fluid intake is excreted as urine in an infant of this age. The nitrogen in the urine computed after removing the albumin was 0.7 and 0.42 grams respectively. The nitrogen in the food for the second day was 0.4 grams, showing very probably no increased excretion during the first day and an even balance on the second day. The ammonia nitrogen was 10 per cent. of the total nitrogen. The uric acid was both quantitatively and relatively increased. On the first day there was an excretion of 0.173 grams of uric acid, being 24.2 per cent. of the total nitrogen in the urine. On the second day the excretion of uric acid nitrogen was 0.107 grams nitrogen, 25.5 per cent. of the total nitrogen in the urine. According to Amberg and Morrell⁶ the uric acid nitrogen as compared with total nitrogen is about 3 per cent.

September 16. The general condition was about the same. The coagulation time was seven minutes.

September 17. Blood examination: Hemoglobin, 110 per cent.; red blood cells, 6,248,000; white blood cells, 17,000. The coagulation time was now prolonged to twenty-five minutes. There were no hemorrhages.

September 18. The child's general condition was not good. The temperature was from 101° to 103°. Pus discharged from both ears. Bleeding started from the mouth, finger tips, and transfusion wounds. The icterus was much more pronounced.

September 19. The general condition was very poor. The temperature 104°. The hemorrhages continued and the stool contained blood. Blood examination: Hemoglobin, 105 per cent.; white blood cells, 12,000; coagulation time, three hours.

September 20 and 21. Child's condition steadily grew worse. Hemorrhages continued. A hemorrhagic vesicular eruption developed. High fever.

September 22. Died, eight days after transfusion. No autopsy was permitted.

The most important facts thus far brought out in this case are: (1) The mother's history of miscarriages (syphilis?); (2) the child nursed at a suppurating breast; (3) the late date (seven days) at which the hemorrhages began; (4) the blood failed to coagulate; (5) the marked temporary effect of the transfusion; (6) reappearance of the original symptoms and progressive loss of the coagulating power; and (7) the child did not die exsanguinated.

³ *Jahr. f. Kinderheilk.*, 1893, xxxv, 21.

⁴ *Zeit. f. Geburtsh. und Gynäkol.* xxxiii.

⁶ *Jahr. f. Kinderheilk.*, 1909, p. 2SS.

CASE II.—*Multiple hemorrhages; prolonged coagulation time; congenital syphilis; sterile blood culture.* Baby H., male, four weeks old. First seen on December 27, 1908. This is the mother's first child; normal birth; breast fed. Father has had syphilis. For the last week the child has been bleeding from the nose (both nares, principally the right). For the last two days he has vomited blood. Yesterday his stools were tarry.

Physical Examination. Small, weazenized, extremely pale infant; frontal bosses prominent, fontanelles large, no craniotabes; dilated veins over scalp. Blood discharging from both nostrils; a few hemorrhagic spots on the palate. Desquamation of skin of hands and feet. Heart: Systolic murmur heard all over the chest. Lungs: Rales over both chests. Abdomen distended; superficial veins dilated. Liver palpable at level of umbilicus, smooth. Spleen palpable three finger-breadths below free border of ribs. Blood smears showed: Polynuclear cells, 62 per cent.; eosinophiles, 1 per cent.; mononuclear, 37 per cent.

The coagulation time showed very marked delay; after five hours a few threads of fibrin had formed. Coagulation experiments done with this blood are described below.

A blood culture was obtained in the following way: A compression bandage was put around the thigh to produce hyperemia of the lower extremity; the foot was thoroughly disinfected and the skin pierced with a Hagedorn needle; the drops of blood were collected in ammonium oxalate solution. Three cubic centimeters of blood collected in this way, and subsequently plated out in agar and glucose agar, remained sterile.

Bleeding from the needle wound as well as from the nose continued until the child's death, which took place eight hours after the child was first seen. The period of observation was so short that more clinical facts could not be brought out.

Autopsy, twelve hours post mortem: Heart muscle pale; lungs show no pneumonia; spleen enlarged, firm; liver large, heavy, light yellow. Intestines show nothing abnormal. Cerebrospinal fluid consisted of dark blood, increased in amount, and under considerable pressure.

A positive Wassermann reaction for syphilis was obtained with this fluid, by Dr. Noguchi, of the Rockefeller Institute.

Microscopic sections showed in the liver the pericellular inflammation characteristic of congenital syphilis. With the Levaditi method numerous *Spirochætæ pallidæ* were demonstrated in the liver, but not in the other organs. The spleen was considerably enlarged and showed a general hyperplasia microscopically.

THE DIAGNOSIS OF HEMORRHAGIC DISEASES IN INFANTS. In discussing the diagnosis of these two cases it is necessary to keep in mind that the hemorrhagic disease of the newborn is not one disease, but is a symptom which may be due to a number of

different causes. All the cases, however, which ought, strictly speaking, to be included under the name "the hemorrhagic disease of the newborn" have two characteristics in common: (a) The bleeding is uncontrollable, and (b) the blood coagulates very slowly or not at all.

Finkelstein⁷ divides these cases, clinically, into two varieties: (1) Cases of multiple hemorrhage; and (2) cases of hemorrhage from one place only.

1. Cases of multiple hemorrhages from surfaces and internal organs generally show severe febrile symptoms and are often due to some form of infection. Their bacteriology is not very well established, as nearly all of the cultures have been obtained post mortem only. Babes "bacillus of hemorrhagic disease" and the bacillus isolated by Kamen in an epidemic of Winckel's disease have not been found by other observers. Two special clinical varieties of disease with multiple hemorrhages have been described. In the one known as Buhl's disease the hemorrhages are accompanied by cyanosis and icterus, but no fever; a marked fatty degeneration of the organs is characteristic. The second variety, known as Winckel's disease, occurs usually in epidemics in institutions; besides the hemorrhages there are icterus and hemoglobinuria. Among the very rare causes of multiple hemorrhages in infants are congenital stenosis of the bile ducts, cirrhosis of the liver, leukemia, and pseudoleukemia. Congenital syphilis may cause either multiple hemorrhages or bleeding from one point. The question whether syphilis alone is the cause of the hemorrhages in these cases, or whether there is a complicating general infection, has been much discussed. Finkelstein believes from a study of seven cases that the hemorrhages are always due to a secondary bacterial infection. He says "a true syphilis hemorrhagica of the newborn does not exist."

Our second case, in which a sterile blood culture was obtained, seems to indicate that bacteremia does not necessarily occur in this class of cases. That a local infection in the nose may have existed in this case cannot be denied. Yet in view of the loss of coagulability this cannot be regarded as the immediate cause of the continued bleeding. That toxic absorption from such a local lesion may be the ultimate cause of the loss of coagulability, is possible.

2. Cases of hemorrhage from a single region, with certain possible exceptions, are probably due to the same causes as multiple hemorrhages. The bleeding in some cases is connected with a local infection at the bleeding point. The most common sources are the umbilicus and the intestines.

Umbilical hemorrhage usually comes from the stump of an infected cord and begins during the first or second week of life. It is generally a slow oozing, and may last for hours or days. It is

usually not a fatal affection. We have no data upon the question of coagulation of the blood in these cases.

Hemorrhage from the bowels in infants may be due to a variety of causes. "*Melena neonatorum idiopathica*" is a term applied to those cases which cannot be ascribed to syphilis, sepsis, or a local lesion. It usually commences before the fourth day of life, and is generally, but not invariably, fatal. Vaginal hemorrhage in infants is very rare; of seven cases collected by Ritter, four were due to septic infections. Nasal hemorrhage is most commonly due to syphilitic rhinitis. Hemophilia naturally suggests itself as a possible cause of hemorrhages in the newborn—especially in view of the fact, now well-established, that in hemophilia also the coagulating power of the blood is much impaired. As a matter of fact, however, hemophiliacs very rarely begin to bleed in the first few months of life, and when they do the hemorrhages are seldom fatal.

Before the blood changes were known the hemorrhagic diseases were often ascribed to lesions of the vessel walls. More recent work has cast much doubt on this, though it is still regarded by some as a possible contributing factor. In considering the etiology of the two present cases, we must ascribe the first case to a general infection, probably derived from the mother's breast, the second to congenital syphilis.

THE PHYSIOLOGY OF BLOOD COAGULATION. In spite of the enormous amount of work that has been done on the physiology of coagulation, that subject is not yet clearly understood. There are many important facts, however, on which there is practical agreement. It has, of course, been known for many years that fibrin ferment, which acting on fibrinogen forms fibrin, does not exist in the circulating blood, but is formed from at least two preëxisting substances, and this only in the presence of a third substance, calcium ions.⁸ Of the two preëxisting substances, the one, generally called prothrombin, is probably (though by no means certainly) present in the plasma. The other, thrombokinase, the activating substance, is never present in the circulating blood, but is only produced from certain nucleated cells (and according to Morawitz⁹), chiefly from blood platelets. Large amounts of thrombokinase can be extracted from certain very cellular organs, such as thymus, testis, liver, kidney. The coagulation of the blood in wounds is much hastened by the thrombokinase at once liberated from the injured tissue cells.¹⁰

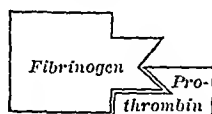
When fresh clot or serum is examined, it is always found to

⁸ Arthur and Pages, *Archives de Physiol.*, 5, ii, 12; Hammarsten, *Jour Physiol.*, 8; *Zeitschr. f. physiol. Chem.*, 22.

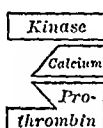
⁹ *Deutsches Archiv f. klin. Med.*, 79.

¹⁰ Rettger (*Amer. Jour. Physiol.*, July, 1909, p. 406), has made certain objections to the thrombokinase theory. We have repeated some of his experiments and believe that by a modified technique Rettger has obtained a very pure fibrinogen, nearly or quite free of prothrombin, and therefore not coagulable by kinase alone.

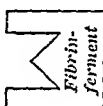
contain free fibrin ferment. Why, then, does not clotting continue to extend indefinitely up the lumen of a vessel, in whose open mouth a clot has formed? This (as well as many other apparently contradictory phenomena) is explained by the antifibrin ferment whose presence in normal blood has only recently been recognized.¹¹ This antifibrin ferment is present in large excess and (in the course of hours) neutralizes any fibrin ferment present in serum. It does not



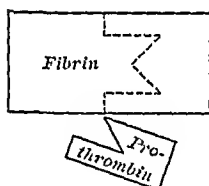
- 1 Represents the normal state of prothrombin loosely attached to fibrinogen (Mellanby).



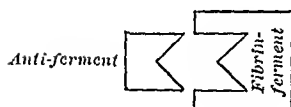
- 2 Represents the elements necessary to the formation of fibrin ferment.



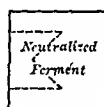
- 3 Represents fully formed fibrin ferment.



- 4 Represents the action of fibrin ferment on fibrinogen to form fibrin and the liberation of the prothrombin which was associated with the fibrinogen. This prothrombin, with the kinase, which is usually formed in excess, forms the free fibrin ferment which is always found in perfectly fresh serum.



- 5 Represents free antifibrin ferment.



- 6 Represents fibrin ferment neutralized by the anti-fibrin ferment.

A scheme to illustrate the relationships believed to exist among the substances involved in coagulation. (Based on the theories of Mellanby and of Morawitz.)

affect kinase or prothrombin, but only fully formed fibrin ferment. It has less affinity for fibrin ferment than fibrinogen has (otherwise clotting would never occur at all).

The accompanying diagram may help to make the relations of

¹¹ Mellanby, Jour. of Physiology, 1, 1909; Morawitz and Jossen, Deutsches. Archiv f. klin. Med., 1908, xciv, 111.

these substances clear. It should be understood that the diagrams represent merely relationships, and that nothing is implied as to whether the substances unite with each other as chemical entities.¹²

PATHOLOGICAL CHANGES IN COAGULATION. In the disease under discussion the essential change in the blood is impaired coagulability. It is worth considering the things which may produce this condition experimentally or which might be conceived to cause it pathologically.

1. *Total Absence or Diminished Amount of Fibrinogen.* In the absence of fibrinogen, of course no coagulation can occur. Experimentally, numerous observers have found that various things which destroy liver parenchyma cause the blood to become uncoagulable, due to absence of fibrinogen.¹³ The condition has never been known to occur clinically. As to a diminished amount of fibrinogen, one of the most interesting points brought out in Mellanby's recent study of the physiology of coagulation is that increasing the amount of fibrinogen actually lengthens the coagulation time (that is, the time for the formation of a definite amount of fibrin), and conversely, diminished fibrinogen means shortened coagulation time. This, if true, seems to us to offer at least a partial explanation of the much shortened coagulation time seen usually in severe hemorrhages (when a considerable portion of the fibrinogen in the body may be lost).

An experiment performed in each of the cases described in the present paper showed conclusively that there was enough fibrinogen present in the blood to cause the formation of a normal clot. To a large drop of the infant's blood, which had not clotted after several hours, was added as much normal blood (from the finger) as could be carried on the point of a pin. Coagulation always occurred in from two to four minutes.

2. *The Absence or Diminution of Calcium.* While the presence of dissolved calcium salts is absolutely essential to the formation of fibrin ferment, there is some question whether calcium is ever diminished to such an extent as to cause pathological interference with the coagulation. Recent work¹⁴ has cast much doubt on the therapeutic value of calcium in hemorrhagic conditions. In both of the present cases experiments were performed to determine whether lack of calcium was the cause of the interference with coagulation. Small amounts of dilute calcium chloride (0.1 to 1 per cent.) were added to drops of the blood. No coagulation occurred. It therefore seems probable that in these cases the failure to coagulate was not due to lack of calcium.

¹² On this question, and for the researches on which the present abstract is founded, see Bayliss, *The Nature of Enzyme Action*, 1908, p. 73; Mellanby, loc. cit.; Morawitz, loc. cit., and *Ergebnisse d. Physiol.*, 1905, 4, 307; Pekelharing, *Biochem. Zeitschr.*, 1908, 11, 1; Wolf, *Arch. Internat. de Physiol.*, 1906 and 1907.

¹³ Doyon, *Comptes rendus Société de Biologie*, 1905, lviii.

¹⁴ Addis, *Quarterly Jour. Med.*, January, 1909.

3. *The Absence of Prothrombin.* There is no evidence as to whether this ever occurs in disease. It is said to be brought about by experimental phosphorus poisoning.¹⁵

4. *The Absence or Diminution of Thrombokinase.* That different tissues and cells vary widely, some liberating large amounts of thrombokinase, others almost none, is well known. There is no direct experimental proof that the quantity of kinase that can be obtained from a given tissue varies under physiological or pathological conditions.

Sahli,¹⁶ in 1895, first suggested that the disease hemophilia might be due to deficiency of thrombokinase—a definite ferment anomaly of all the body cells. Recently Morawitz and Lossen¹⁷ have practically proved this—have shown that in hemophilia the prolonged coagulation of blood drawn directly from the veins is due to deficiency of kinase, and Morawitz and Bierick¹⁸ have proved the same in the prolonged coagulation of cholemia.

An experiment performed with the blood of the first case described in this paper proved that absence of thrombokinase might have been the factor. A drop of ascitic fluid was added to a drop of the blood. No coagulation occurred.

Now serous fluids are said to contain all the elements necessary to coagulation except kinase; they have no cells which can give rise to kinase, and they, therefore, coagulate on the addition of kinase alone (Mellanby). It follows that in the experiment done, if the child's blood had contained kinase, coagulation should have occurred.

While too much should not be inferred from a single experiment, particularly as no control experiment was done to show that the specimen of ascitic fluid used would coagulate on the addition of kinase, nevertheless, the experiment does seem to narrow the possibilities to two: either thrombokinase was absent, or some pathological, inhibiting substance was present.

5. *Coagulation Inhibiting Substances.* Many of the substances which can prevent coagulation experimentally, such as hirudin, snake venoms, acids and alkalis, and substances like oxalates, citrates, and fluorides, which act by precipitating calcium, do not need to be considered in the present connection. It is interesting that exceedingly small amounts of some of these substances are enough. Thus, hirudin (Merck) prevents 7000 times its own weight of blood from coagulating.

(a) *Bile.* Bile salts in the test-tube not only prevent the action of formed fibrin ferment, but prevent its formation; this, however, only happens in such concentrations (0.5 per cent.) as never occur

¹⁵ Doyon, *Comptes rendus Société de Biologie*, 1905, lviii, 852; Corin and Ansizus, *Vierteljahrsschrift f. gerichtliche Medizin*, iii, 434 (quoted from Morawitz and Bierick, loc. cit.).

¹⁶ *Zeitschrift f. klin. Med.*, 1, 264.

¹⁷ *Deutsch. Archiv f. klin. Med.*, 1908, xciv, 111.

¹⁸ *Archiv f. experiment. Pathol. u. Pharmacol.*, lvi, 115.

in the body blood.¹⁹ Furthermore, it is well known that the tendency to hemorrhage is independent of the degree of icterus, and, indeed, the hemorrhages sometimes occur after the icterus has disappeared. These facts indicate that it is not the mere presence of bile in the blood that causes cholemic hemorrhages. Exactly what does cause the interference with coagulation in these cases is unknown; but Morawitz and Bierich have advanced our knowledge one step by showing that whatever the toxic substance is, it acts by preventing the secretion of thrombokinase.

That the same factor may have been at work in the two cases under discussion is possible; in the first there was only a moderate jaundice, but destruction of liver cells was the most marked lesion in the body.

(b) *Peptone*. It has been known for a long time that the injection of peptone or albumose into the circulation retards or prevents coagulation. Delezenne,²⁰ in 1898, showed that if peptone is circulated with blood through a living liver, not only will the blood itself not clot, but it will prevent clotting if added to the freshly drawn blood of another animal. The peptone evidently acts, then, by inducing the formation of some coagulation-inhibiting substance in the body. It is known that traces of peptone are occasionally found in the blood in leukemia,²¹ and it seems to us that this may possibly have some connection with the delayed coagulability and the tendency to hemorrhages so often seen in some forms of leukemia. In the absence of any evidence to the contrary, this also may be tentatively regarded as one of the possible causes of the condition of the blood in the disease under discussion.

(c) *Acids*. The influence of acids on coagulation is very great. Mellanby finds that $\frac{1}{5000}$ normal hydrochloric acid delays the onset of coagulation, and $\frac{6}{10000}$ normal hydrochloric stops it. He states that the importance of the observation lies in its application to the non-coagulable state of the blood which often accompanies acid intoxications.

It seems to us, however, that the inference should be very cautiously accepted. In Mellanby's experiments the reaction was actually acid, whereas it is well known that in no form of acid intoxication does the reaction of the circulating blood ever become acid. Furthermore, the most common clinical types of acid intoxication are not accompanied by loss of blood coagulability.

(d) *Products of Autolysis*. In 1902 Conradi²² published the results of experiments in which he proved that coagulation-inhibiting substances of unknown nature, to which he gave the name "anti-thrombin," were produced in the aseptic autolysis of organs. These substances are evidently entirely different from the antifibrin

¹⁹ Morawitz and Bierich, loc. cit.

²⁰ Travaux de Physiologie, Université de Montpellier, 1898.

²¹ Erben, Zeitschr. f. klin. Med., 1900, 262.

²² Hofmeister's Beiträge, 1902, i, 136.

ferment of normal serum because they are not injured by boiling, whereas the antifibrin ferment of serum is completely destroyed by 70° C. for a few minutes.

In Conradi's experiments intravascular injection of these products of autolysis did not produce any very marked effects. Nevertheless, it is conceivable that substances of this nature might be absorbed and cause delayed coagulation in the body.

With regard to the question of an inhibiting substance in the two cases described in this paper, the experiments described above indicate that there was no coagulation-inhibiting substance in the blood, but that if any inhibiting substance was present it must have been a substance capable of preventing the formation of fibrin ferment, but not the action of the latter after it was once formed. For in both of the cases the addition of an exceedingly small (though, we regret, not accurately measured) proportion of blood from any normal person caused clotting in approximately the time required for the coagulation of normal blood.

THERAPY. We do not intend to enumerate the various measures which have been tried in the hemorrhagic disease of the newborn. In Case I, calcium chloride was administered, with no effect on the coagulation. From the experiment described above no effect was actually to have been expected from this treatment.

In Case I, also, a subcutaneous injection of 20 c.c. of horse serum (not fresh) was given; there was no effect either on the coagulation time or the clinical symptoms.

The use of serum by subcutaneous or intravenous injection in the treatment of hemorrhagic conditions due to diminished coagulability is new,²³ and its value is still sub judice. Many favorable cases have been reported.²⁴ Most of these are rather unsatisfactory, as they are simply reports of recoveries after serum injections, in conditions many of which are recovered from spontaneously. Weil, who first used the serum treatment, studied his case of hemophilia carefully; he found that there was marked shortening of coagulation time after intravenous injections of serum; this remained for about a week, and was only completely lost after five weeks. He does not state how old his serum was. All the recent writers insist that the serum must be fresh, on account of the well-known disappearance of fibrin ferment from serum on standing.

Nevertheless, the expectation that the injection of serum will alter the coagulating power of the circulating blood runs so contrary to our physiological data that we prefer to remain skeptical as to the value of this form of treatment. The considerations which lead us to this point of view are as follows:

²³ P. Emile Weil, *Presse médicale*, October 18, 1905.

²⁴ Broca, *Medizinische Klinik*, 1908, p. 1445; Carrière, *Münch. med. Wochenschr.*, 1907; Lommel, *Centrabl. f. innere Med.*, July, 1908; Leary, *Boston Med. and Surg. Jour.*, July, 1908; Welch, *Amer. Jour. Med. Sci.*, 1910, cxxxix, 800.

The injection of large amounts of fibrin ferment into the circulation causes extensive intravascular clotting, and often death. This is the chief reason why the old method of transfusion by the injection of defibrinated human blood was given up.²⁵ And it has been repeatedly shown that intravascular injection of small amounts of thrombokinase causes death rapidly with multiple thrombi.²⁶ In other words, the actual presence of fibrin ferment in the circulating blood is very dangerous.

On the other hand, the injection of moderate amounts of fibrin ferment gives no trouble, because (as we now know) the fibrin ferment is rapidly neutralized by the excess of antifibrin ferment in the blood. A considerable quantity of very active fibrin ferment may be injected into the blood current of a living animal without producing clotting at all.²⁷ This is the reason that there have been no fatalities following the intravenous injections of serum. The difficulty with the serum treatment, then, from a theoretical standpoint, is that the fibrin ferment contained in an ordinary dose (10 to 30 c.c.) of serum is at once neutralized by the antifibrin ferment of the circulating blood.

There is nothing to show that fibrin ferment, once it is neutralized by antiferment, can be subsequently liberated. It is, of course, conceivable that the elements of fibrin ferment may be picked out and subsequently used in the production of prothrombin and thrombokinase by the cells which produce these substances. This would afford a rational explanation of the serum treatment.

The studies on the serum treatment have been almost entirely clinical. Recently, however, Baum²⁸ has reported on experiments with rabbits whose blood was made uncoagulable or only slowly coagulable by hirudin injections. In cases in which the coagulation was merely prolonged he found that blood withdrawn at once (five to ten minutes) after a serum injection coagulated somewhat more rapidly. When enough hirudin was given to make the blood uncoagulable, the serum had no effect at all.

At the same time Baum reported on three cases of hemophilia. In two of these serum injections were absolutely without influence. In the other case they seemed to have some, though slight, effect. We would like to add that we have seen two hemorrhagic cases (of jaundice) in which the injection of fresh serum was futile.

What has been said does not apply, of course, to the local application of fibrin ferment, in the form of serum, to the bleeding point.

We have one other therapeutic measure to consider. Transfusion, since Crile re-introduced it, has been used successfully in many hemorrhagic cases, particularly in those due to prolonged jaundice.

²⁵ Landois, *Die Transfusion*, 1875; Billroth, *Die Transfusion*, etc., 1886.

²⁶ Conradi, loc. cit., p. 166.

²⁷ Foster, *Text-book of Physiology*.

²⁸ Mittheilungen a. d. Grenzgebiet, etc., 1909, xx, 1.

Recently its succesful use in a case of hemorrhages of the newborn has been reported.²⁹

Transfusion not only replaces the lost blood, but stops the hemorrhages by supplying new material for the production of fibrin ferment, as was seen in the case described above. Transfusion does not, of course, remove the original cause of the disease. This also is well illustrated by our case, in which, as the underlying septic condition continued, the coagulating power of the new blood also was gradually destroyed.

CONCLUSIONS. 1. Impaired blood coagulation is the immediate cause of uncontrollable hemorrhages in the newborn.

2. This is probably due to destruction of, or interference with, the production of thrombokinase.

3. Bacterial infection is the most frequent underlying cause of the disease; but

4. Syphilis alone can cause the disease without bacterial infection.

5. The value of serum injections is doubtful.

6. It is important that transfusion should be tried when ordinary measures have failed.

THE RADIOGRAPHIC DIAGNOSIS AND CLASSIFICATION OF EARLY PULMONARY TUBERCULOSIS.

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It is acknowledged by nearly all physicians that in making the early and positive diagnosis of pulmonary tuberculosis lies the only hope of permanent cure. Much time and energy have been expended in the search for a specific when the specific was at hand and free to all, and very positive in cases in which the diagnosis is made as early and positively as it may be made by radiographic examination.

SYMPTOMATOLOGY. If pathology is the foundation of all diseases, then symptomatology is the superstructure that we all see and feel and causes the patient to consult the physician. The subjective symptoms vary extensively on account of the observation of the patient and his methods of description, and there are great variations of symptoms caused by similar pathological lesions. Leading questions are asked by the physician, and some will record one symptom and some another. The history often resembles the physician who records it, rather than the patient who makes it.

OBJECTIVE SYMPTOMS. Objective symptoms depend very largely on the observations of the physician. Routine examination will

²⁹ V. Lambert, Medical Record, May 30, 1908.

often improve one's power of observation, but a "Sherlock Holmes," though a layman, may observe many symptoms that escape the attention of even a trained "Dr. Watson," but the careful observer may not be able to attribute the proper value to the symptoms.



FIG. 1.—Radiogram of a lung which had been removed from the body and inflated to about the normal extent. The lower lobe shows the earliest stage of congestion, preceding a pneumonic process which had extended from the opposite side. *A*, normal markings of the lung; *F*, thickening around the root; *I*, old calcified tubercles. The apex shows infiltration, and isolated (*X*) and conglomerate (*Z*) tubercles, and (*H*) consolidation. This figure shows about the same detail which one is able to obtain in a favorable living subject.

HEMOPTYSIS. Hemoptysis is such an important symptom that it deserves special mention. It may be one of the first symptoms of acute infection, or it may be caused by old calcified tubercles seratching through the bronchial membrane (Fig. 20, I).

PHYSICAL SIGNS. Very closely associated with the objective symptoms are the physical signs. They have been, and always will

be, the sheet anchor of pulmonary diagnosis; and on account of its being a tool that every physician has, it should be used to its utmost capacity. I have made several series of radiograms of cases that had previously been examined by some of the most eminent physical diagnosticians in New York, and I think that all of them admit the value of the x-rays. Some of them rely very largely on the radio-



FIG. 2.—Radiogram of a lung which is as nearly normal as any I have ever seen, and shows the following detail (both lungs being equally aerated): *A* normal markings of the lungs; *B*, border of heart, shows distinctly, normal in size, shape, and position; *D*, dome of diaphragm; *F*, root of lung; *I*, calcified tubercles; *L*, calcified costal cartilages. It is possible to obtain this detail in a patient of moderate size, when the aëration of the lung is complete.

graphic findings to determine whether radical treatment is necessary in border line cases; and one of the most eminent diagnosticians has modified his interpretation of the physical signs, especially the "harshness of breath sounds."

Physical signs may be divided into distinct classes: (1) Those which are directly the result of tuberculous infiltration, such as, dullness, increased fremitus, and changes in voice and breathing. These

are the real physical signs of tuberculous infiltration and consolidation, and naturally do not occur until the process has passed out of the stage of incipency. (2) The physical signs on which the diagnosis of incipient tuberculosis is based, such as slight localized rales, or "clicks," as they are sometimes called; these are not the physical signs of infiltration or consolidation, but the signs of a localized pleurisy or bronchitis which may or may not be of tuberculous origin. On the other hand, this localized bronchitis or pleurisy may not occur until the tuberculous process has reached

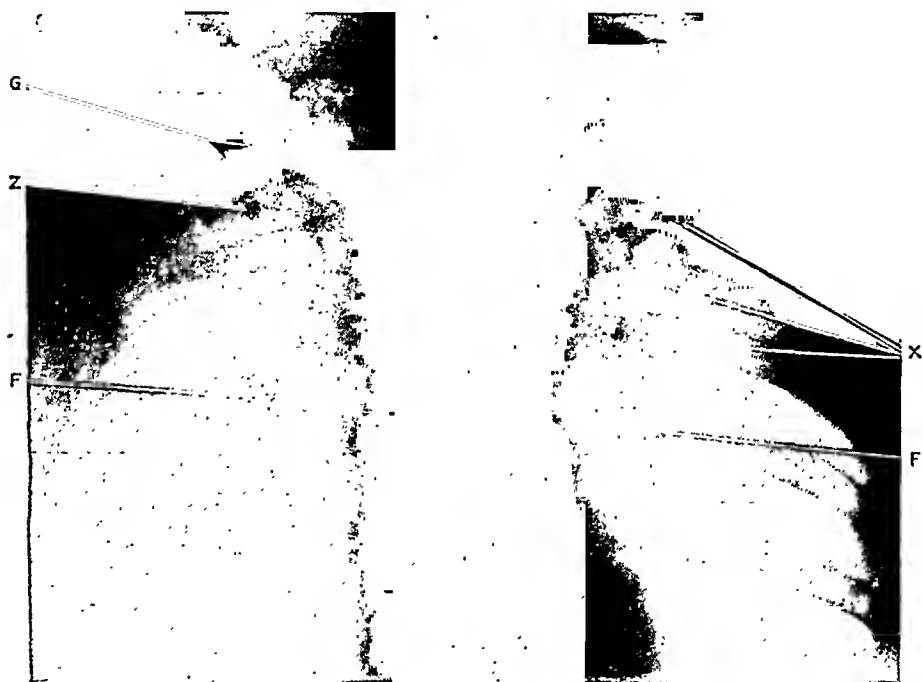


FIG. 3.—Symptoms were classical of a tuberculous process. Physical signs indicated an incipient lesion at the left apex; the right apex was *normal*. There was diminished aëration of both apices; the heart was normal in size, shape, and position; the diaphragm is not shown. *F*, thickening around both roots, typically tuberculous; *G*, infiltration of both apices with large, soft, isolated (*X*) and conglomerate (*Z*) tubercles, indicating an exudative type of infection. The process is a little more advanced on the left side, where the physical signs were found, but more extensive in the right, where there were no physical signs. *X*, isolated tubercles; *Z*, conglomerate tubercles.

such an advanced stage that it is accompanied by dulness and increase of voice and breathing, and by that time the process has reached a stage in which pathologically or radiographically it could not be considered in its incipency.

About once in three or four times, in equivocal cases, we find a patient in whom the bronchitis has not developed, or at least has not been discovered, until the infiltration is well marked radiographically, and yet the process has not reached a stage that will give dulness or increase in voice or breathing. This is especially true when the

process is a direct extension from the root or is located posteriorly under the scapula.

I have been criticised for stating that certain plates showed individual miliary tubercles. That there may be no misunderstanding of the term "miliary tubercles," I quote the definition of miliary tubercles from Delafield and Prudden:¹ "Miliary tubercles are small nodules of irregularly spheroidal shape, the smallest hardly visible to the naked eye, the largest as large as a pea." "The term miliary tubercle, which arose from the crude coincidence in size between small foci of tuberculous inflammation and some forms

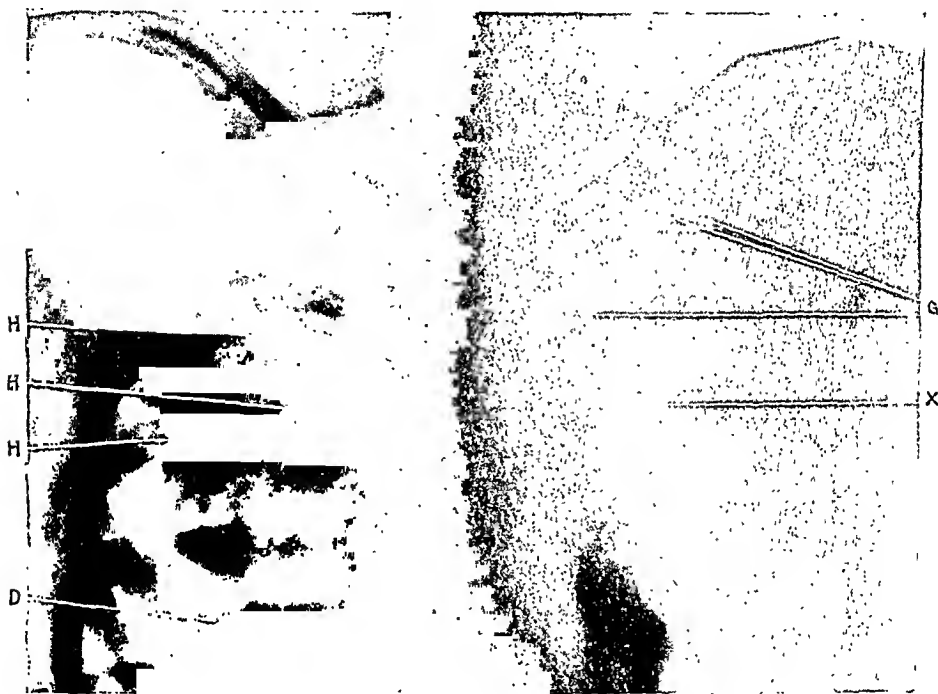


FIG. 4.—The symptoms and physical signs were classical in this case, and there were tubercle bacilli in the sputum. The plate is shown only to illustrate a typical exudative process in the stage of consolidation. There was diminished aëration of both lungs. The heart was normal in size, shape and position. *D*, diaphragm retracted on the right side (Williams' sign); *G*, infiltration of the left lung; *H*, three small areas of complete consolidation of the right lung; *X*, isolated tubercles in the left lung.

of millet seeds, is now liberally applied to tubercles which are much larger as well as those which are much smaller than millet seeds."

In speaking of miliary tubercles, I refer to those of moderate size, which on cross section of the lungs appear as grayish-white nodules about the size of a pin head. Pathologically these are composed of exudate or productive tissue in a number of adjoining air cells. In studying them radiographically they are compared

¹ Pathology, p. 216.

in density with the air which should normally fill those cells, instead of tissue of similar density, as is the case in tuberculous infection in any other part of the body. This is the reason why individual tubercles show in the lung and not in any other tissue in the body. It is universally admitted that the larger necrotic and calcareous tubercles show; I do not claim to show the microscopic ones. But it is the intermediate tubercles, the smallest ones that are clearly discernible by the naked eye on the cross section, those that give the "shotty" feeling to the cut surface of the lung; that show distinctly in a radiogram having sufficient detail. It is on these tubercles that the positive diagnosis of incipient pulmonary tuberculosis by the x -rays depends.



FIG. 5.—Is one of a patient with typical symptoms of pulmonary tuberculosis. Physical signs indicated only a slight involvement. The radiogram, however, showed the following detail: *A*, normal markings of the lungs show fairly distinctly; *B*, heart normal in size, shape, and position; *F*, typical mottled infiltration around the right root, which is the only indication of infection on the right side; *G*, infiltration of the middle of the left lung, below which the process has reached the stage of consolidation (*H*), and above which is a cavity (*K*) about 3 cm. in diameter.

SPUTUM EXAMINATION. The diagnosis is absolutely positive if the tubercle bacilli are found in the sputum, but they are usually not found until physical signs have developed and the disease has passed out of the stage of incipency. One is certainly not justified in waiting until they are found before making a diagnosis.

TUBERCULIN TESTS. The tuberculin tests are the greatest aid in determining the presence of a tuberculous process somewhere in the body. It is manifestly not within the scope of this paper to

discuss the dangers and value of these tests except as compared with radiography.

Von Pirquet states that during a year and a half he made a cutaneous test on all the children who were admitted to the children's clinic of Professor Escherich in Vienna, and that 93 per cent. of the children, fourteen years of age, reacted to the tests, and in only 13 per cent. was there manifest tuberculosis. This corresponds so accurately with the radiographic findings that it would be interesting

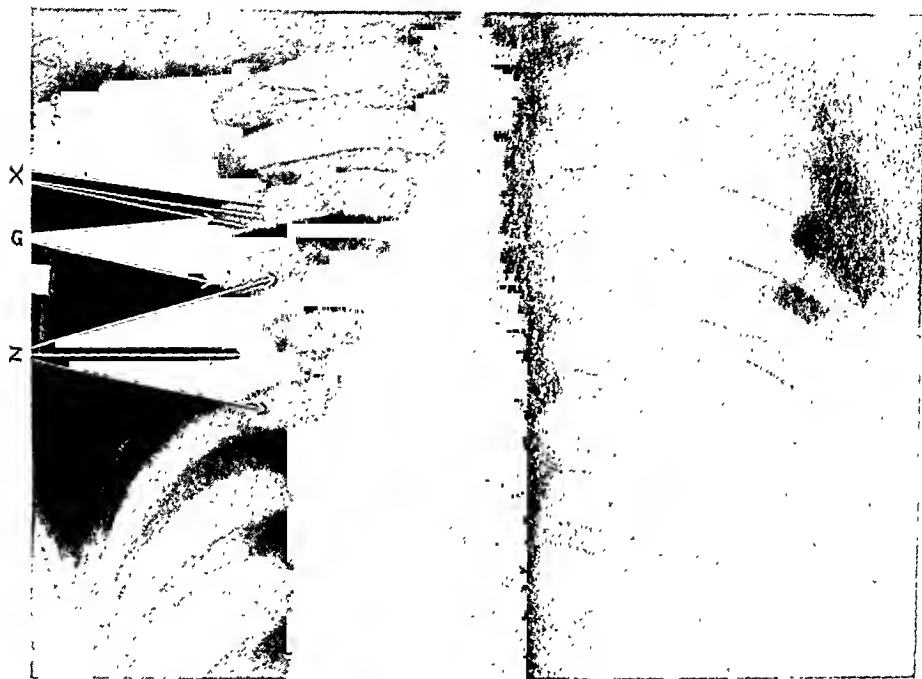


FIG. 6.—Posterior view of the same patient as shown in Fig. 5; the cavity, being nearer the anterior wall of the chest, does not show in this figure. The infiltration has not reached the stage of consolidation posteriorly, but shows the typically mottled appearance of a tuberculous infiltration, (G); X, small, isolated tubercles; Z, large, conglomerate tubercles.

to know what part of the 87 per cent. that showed no manifest lesion would have shown a distinct lesion around the root of the lung on radiographic examination. Unfortunately the tuberculin tests do not show the activity, location, or extent of the lesion.

The search for a specific which has resulted in the tuberculin tests led out of the rut of symptomatology and physical diagnosis, opened up a new field of laboratory tests, and created a demand for more accurate methods of diagnosis.

The Röntgen rays presented themselves as a candidate before the technique of making radiograms was perfected; attempts were made to use them either fluoroscopically or radiographically in the diagnosis of pulmonary lesions, and much was claimed for them that could not then be substantiated. The whole field of Röntgen-

ology savored just enough of the magic art to be a fertile field for fakirs and charlatans. Many physicians who had failed in other branches of medicine flocked into this without any instruction or experience; and many of them did not know the first principles of electricity or photography, and only a moderate amount of medicine. Some general practitioners, with little or no experience, would look



FIG. 7.—This case was radiographed to show an œsophageal stricture; although there were slight physical signs, they were not considered of importance. Radiographic findings: Diminished aëration of the entire right lung and left apex; *B*, heart is drawn into the vertical position—Hickey's symptom; *F G*, thickening around both roots; *G*, tuberculous infiltration of both lungs, more advanced on the right side, behind. The lesion in the right apex illustrates a typical subacute productive process as indicated by infiltration (*G*); *H*, small areas of consolidation in both lungs; *I*, isolated, calcified tubercles; *X*, isolated fibrous tubercles; *Z*, conglomerate tubercles.

in a fluoroscope and claim to see things that an experienced operator knew could not be seen; while others would make radiograms of advanced lesions that could readily be diagnosticated by other methods.

During the evolution of Röntgenology its advocates were divided into two camps—those who favored fluoroscopy, and those who favored radiography; strange as it may seem, few were successful with both methods. The Austrians are the most ardent supporters of the fluoroscopic method. Dr Williams, of Boston, is one of the greatest devotees in this country, and Dr Minor,² of Ashville, Tenn., has just written an article on this method of chest examination. The advantages of this method, as enumerated by Dr. Minor, are as

² The American Treatise on Tuberculosis, edited by Arnold Klebs.

follows: Fluoroscopy is much less work, can be done by any general practitioner who has a static machine or small coil, only requires one tube which may be used for any number of exposures, and is, therefore, much less expensive. There are no plates to be developed, and it does not show the normal markings of the lung, which he says are so confusing to one unfamiliar with such examination.

Dr. Minor states that tuberculous processes are detected about as soon by this method as by a keen physical examination. He admits that radiograms may be made that show a tuberculous process much earlier than can be shown fluoroscopically or by physical examination, but he also says that such radiograms must be made and interpreted by one who is experienced in this line of work. I believe all his points are well taken, but would call attention to the following disadvantages of fluoroscopy: The risk to the operator is too important to be disregarded; he has only the impression gained from a few seconds, or minutes at most, and the personal equation of what he sees and what he does not see is an important factor. Only the grossest and more advanced lesions may be diagnosticated by this method.

The advantages of radiography are as follows: Radiograms may be made without risk to the operator or patient; one has a permanent record which he may study at leisure and compare with radiograms of similar cases, and save to compare with radiograms made at a later stage, to show whether the process is advancing, held in check, or resolving, and many of the cases do resolve. A radiogram may also be used to persuade a patient, who has few symptoms or physical signs, that radical treatment is necessary.

Dr. Minor says the radiogram gives such a wealth of detail that it is confusing and difficult of interpretation, and therefore, the fluoroscopic method is better. It seems just as rational to discard the high power microscope because of the increased detail it gives. It is just the interpretation of this wealth of detail that enables one to make the diagnosis of tuberculosis by radiographic examination very much earlier than by fluoroscopic methods or physical diagnosis.

Rieder in Europe (Munich) and Hulst in America (Grand Rapids, Mich.) were the pioneer workers in rapid radiography of the chest, and much credit is due them; but both used the high vacuum method that does not combine the wealth of detail with the contrast that can be obtained with the low vacuum tube advocated by Leonard.

The following factors are important in the development of soft tissue radiography. (1) The perfecting of the apparatus that enables one to make radiograms of the chest while the patient holds the breath, or even during the diastole of the heart. (2) The improvement in technique, especially as regards the separation of the direct, indirect, and secondary or Sagnac rays.³ (3) The selection of a tube suitable for the apparatus used and the seasoning of

³ Archives of the Röntgen Ray and Allied Phenomena, May, 1905. Archives of Physiological Therapy, December, 1906.

that tube so that it generates a large percentage of direct rays and enables one to make radiograms that show distinctly the muscle, fat, connective tissue, and even the blood in the veins at the anastomosis

FIG. 8



FIGS. 8 and 9.—This is a test case to compare the relative value of radiography and physical who found signs of consolidation at the left apex, but made a negative diagnosis of any more marked on the left than on the right; *B*, heart drawn into the vertical position *H*, consolidation of the left apex, more marked behind; *FG*, infiltration of the right upper with exudate; *K*, bronchiectasis, empty. It would hardly seem possible for a tuberculous but Fig. 10 is a similar case which escaped detection by one of the keenest diagnosticians

of the knee and elbow. This seemed to open up the field of soft tissue radiography, and the lungs offered the most fertile field for its application.

During the winter of 1904-05 I made about one hundred radiograms of incipient or early cases of tuberculosis. Many of the patients were referred from the Vanderbilt clinic after a careful physi-

FIG. 9



signs. The physical examination was made and recorded by a very competent diagnostician. involvement of the right side. Radiographic findings: Diminished aëration of both apices; (Hiekey's sign of tuberculosis); *D*, diaphragm retracted; *F*, thickening around both roots; lobe, small area of consolidation; *K*¹, dilatation of the right descending bronchus filled process to reach the stage that is shown in the right lung without giving physical signs, in this city.

cal examination had been made and recorded by Dr. Austin Riggs and at least one or two other members of the medical staff. If they all agreed as to the physical signs, the case was only radiographed to

show the more advanced lesions; if they disagreed either on the character or location of the signs, the patients were radiographed and later the radiographic findings were compared with the physical signs.

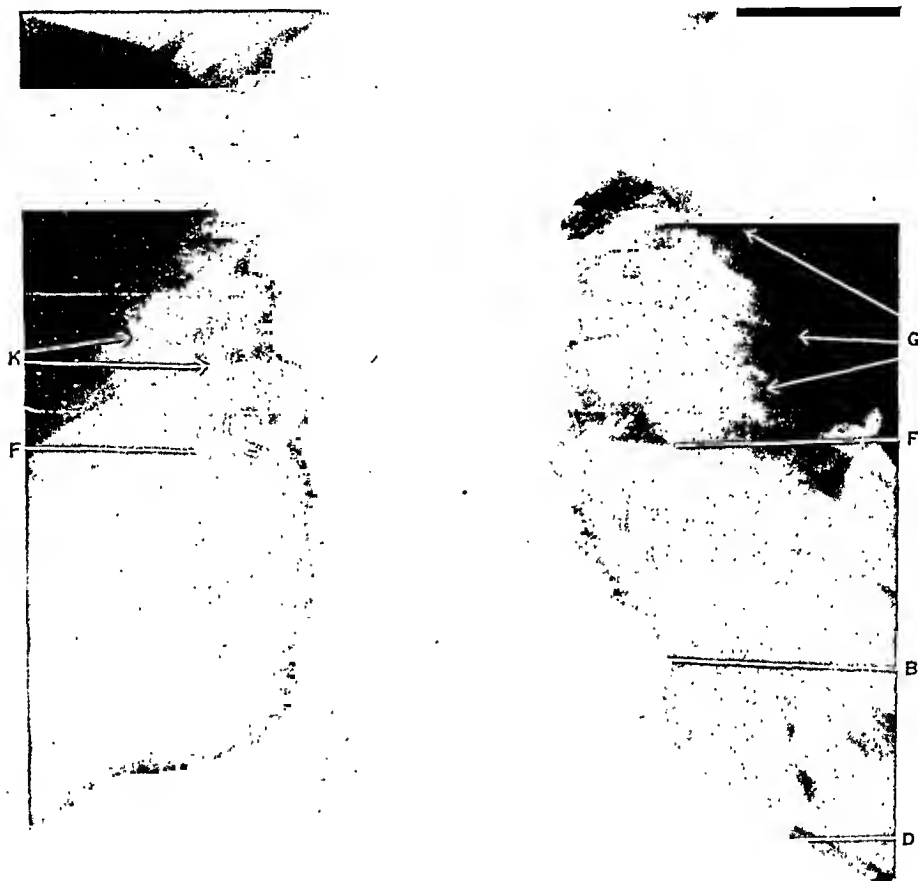


FIG. 10.—Illustrates how extensive a tuberculous process may exist without one of the keenest physical diagnosticians being able to detect it. A process had been detected at the right apex, and the patient was radiographed to determine whether there was a cavity. Physical signs of a cavity at the right apex. Equivocal signs above the clavicle on the left side, no physical signs below. Radiographic findings: Diminished aeration over both lobes, more marked on the right side; B, heart small; D, diaphragm normal; F, typical tuberculous infiltration around both roots; G, infiltration of the entire right lobe; K, ill-defined cavity at the right apex.

In every case in which the physical signs were present a well-defined lesion was found in the radiogram, and in many cases there were lesions in the opposite lung that gave no physical signs. This occurred in so many cases that I hesitated to make a diagnosis of tuberculosis, and decided to make radiograms of lungs post mortem.

Specimens were selected that had been removed from the thorax without tearing the pleura, they were drained of as much of the oedematous fluid as possible, inflated to about the extent of normal inspiration, and radiographed. These radiograms, one of which is shown in Fig. 1, showed just about the same detail that it is possible



FIG. 11.—The history was typical of mixed infection with high temperature, sweats, cough, and expectoration; and physical signs of consolidation and cavity formation. This figure is to illustrate the necrotic type of infection. Posterior view: Diminished aëration at both apices, more marked on the left; A, normal markings; B, heart normal in size and shape and drawn somewhat into the vertical position; D, diaphragm normal; F, thickening around both roots, more marked on the left; K, multiple cavities without thickened walls and filled with exudate; I, calcified tubercles.

to obtain in a favorable living subject (Fig. 2), and shadows similar to those seen in the cases from the Vanderbilt clinic were found in all these lungs.

The specimens were then sectioned and compared with the radiograms; in most of the cases the lesions were readily found and identi-

fied as tuberculous. But some of the shadows, that resembled isolated tubercles scattered through the lung, were caused by one small bronchus or bloodvessel crossing the other, as seen on end section. One specimen of a child's lung appeared normal on external examination, but the radiogram showed several distinct old



FIG. 12.—History of fifteen years of slight hacking cough, no expectoration, no tubercle bacilli in the sputum; slight physical signs; this is the most typical case of chronic miliary tuberculosis, involving the greater part of both lungs. Diminished aëration of both lungs. *B*, heart small and drawn into the vertical position; *D*, diaphragm arched up in the median line, thorax contracted; *F*, thickening around both roots; old calcified tubercles and fine mottled infiltration. Infiltration of both lungs, with extremely small, isolated (*X*) and conglomerate (*Z*) tubercles; *I*, calcified tubercles. The process shows no tendency to consolidation.

calcified lesions. On careful cross section these were not found, and the lungs were reported normal by the pathologist. Fortunately the sections were saved, and when these spots were localized by sticking hat pins in at different angles and making more radiograms, they were readily located; and when they were examined microscopically, they were reported as being tuberculous.

To the ultra scientific man this examination was unsatisfactory because the lungs had been removed from the thorax. I therefore tried to radiograph corpses at the morgue, just before autopsy, and other cases were radiographed immediately before and after death; but all these radiograms had the same appearance, and did not resemble the lung in the living subject as closely as did the inflated lung. It is largely on this series of radiograms of postmortem specimens that the interpretation of the accompanying plates is based.

Radiographically the following varieties of lesions may be recognized, but how accurately these coincide with the pathological classifications can only be proved by further pathological radiography.

CLASSIFICATION I.

Acute and subacute.	1. Exudative.	<ul style="list-style-type: none"> 1. Isolated tubercles, large and soft (Fig. 3, X). 2. Conglomerate tubercles (Fig. 3, Z, and Fig. 6, Z). 3. Consolidation: large areas of consolidation surrounded by soft tubercles (Fig. 4, H).
	2. Productive.	<ul style="list-style-type: none"> 1. Small isolated tubercles with clear-cut, well-defined edges (Fig. 7, X). 2. Union of three or four tubercles to form a conglomerate tubercle (Fig. 7, Z). 3. Small areas of consolidation (Fig. 7, H). 4. Fibrous appearance extending from the root and connecting areas of consolidation (Fig. 7, F, G, and Fig. 9, F, G). 5. Complete consolidation (Fig. 8, H).
	3. Necrotic Cavity.	<ul style="list-style-type: none"> Single (Fig. 5, K). Multiple (Fig. 11, K.) Full of exudate (Fig. 11, K). Empty (Fig. 5, K). Without thickened walls (Fig. 11, K). With thickened, calcified walls (Fig. 5, K).
Chronic.	Miliary.	Small, clear-cut, well-defined isolated tubercles involving the greater part of both lungs without consolidation (Fig. 12).
	Fibroid.	Fibrous consolidation with retraction of the ribs and diaphragm and displacement of the heart (Fig. 13).
	Calcareous.	Few, scattered, calcified tubercles at the right apex (Fig. 21, I). Group of calcified tubercles around the root causing hemoptysis (Fig. 20, Z).

The pure type of each of these varieties may readily be differentiated from one another, but when the exudative and productive processes are each present to about the same extent, it is difficult to state which is which. Necrosis may occur in either exudative or productive processes, and the calcareous deposits represent old healed lesions of either type. The acute or subacute exudative tuberculosis process is recognized radiographically in its early stage by large, soft, isolated tubercles (Fig. 3, X), the edges of which are not clear cut and well defined. It has a great tendency, even in the

early stage, to the formation of conglomerate tubercles (Fig. 3, *Z*) or small areas of consolidation. These go on rapidly to the typical form indicated by small areas of consolidation (Fig. 4, *H*) surrounded by large, soft, individual, or conglomerate tubercles. This variety of lesion may reach the stage of almost complete consolidation before the keenest ear detects the physical signs. Note the history under Fig. 3.



FIG. 13.—A case of chronic, fibroid tuberculosis, so-called fibroid phthisis. The left side of the chest is retracted. *B*, heart is drawn over to the left side, or some say pushed over by the compensatory emphysematous lung. In the upper lobe there is a typically mottled infiltration (*G*).

The subacute productive process is most typical in the early stage. The tubercles (Fig. 7, *X*) are small, dense, more isolated, and their edges are clear cut and well defined; and where several unite to form a conglomerate tubercle (Fig. 7, *Z*) they do not lose their identity. It does not go on rapidly to the stage of consolidation (Fig. 7, *H*), and the areas where it does occur are small and circumscribed; it can readily be traced back to the extension from the root by the fibrous appearance (Fig. 7, *FG*) that radiates from the root and connects the areas of consolidation.

The productive process may reach the stage of infiltration, or even consolidation (Fig. 8, *H*), or with cavities (Fig. 8, *K*), before physical signs develop, as is illustrated in Figs. 8, 9, and 10; in these cases the most careful physical examinations were made.

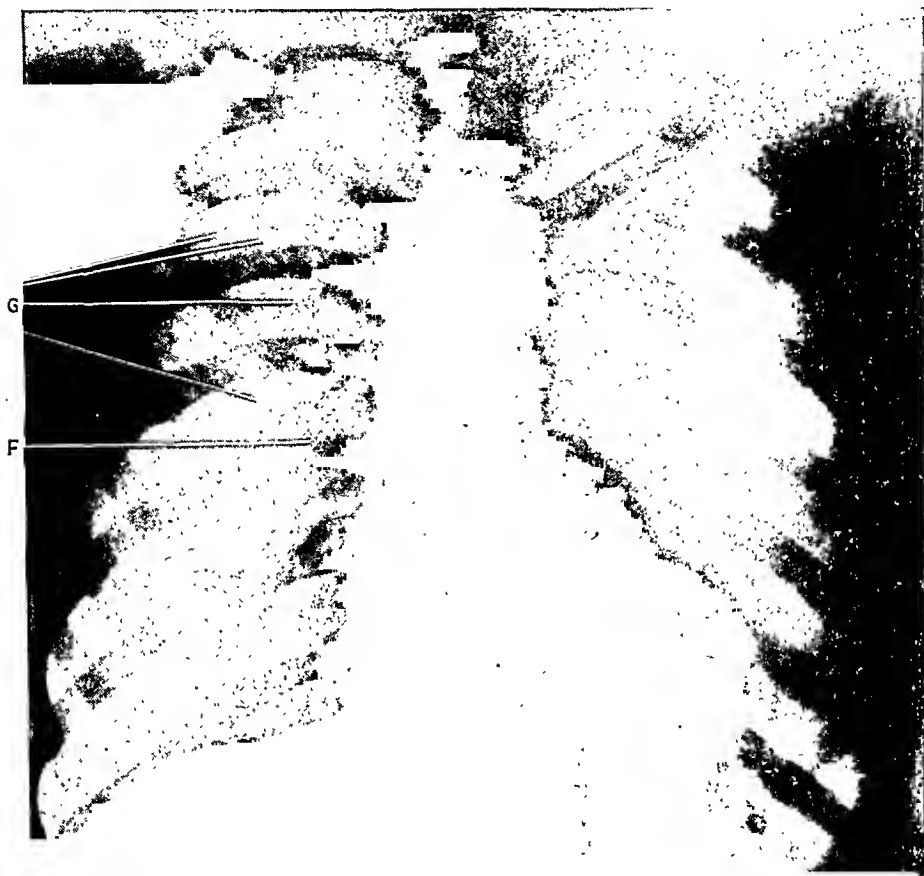


FIG. 14.—Illustrates the bronchial or peribronchial type of infiltration radiating from the roots of the lung. History equivocal. Physical signs: Few rales at the right apex, just below the clavicle, no dullness, or change of voice or breathing. Radiographic findings: Diminished aëration of both upper lobes, more marked on the right side; heart normal in size, shape, and position; diaphragm normal; *F*, typical thickening around the right root; *G*, radiating from both roots to the apices, more marked on the right side, are thickened bronchi without infiltration of the air cells supplied by them. This radiogram is especially interesting when compared with the following one (Fig. 15), where the process has extended and where there is an infiltration of the air cells.

Necrosis may occur in either the exudative or productive process, and the necrotic areas may be full of exudate and hard to differentiate (Fig. 11, *K*) from the surrounding consolidation, or they may be empty and the cavity show distinctly (Fig. 5, *K*). There may be multiple cavities (Fig. 11, *K*) in a consolidated area, with little or no attempt at walling off; or there may be a large cavity with a dense wall, probably infiltrated with calcareous deposits (Fig. 5, *K*).

Chronic miliary tuberculosis is recognized by the extremely small, clear-cut, well-defined tubercles (Fig. 12, *X* and *Z*). In the most typical case that I have seen both lungs were equally effected, the process showed no tendency to consolidation, and there was not the fibrous appearance usually presented in the chronic fibroid consolidation.

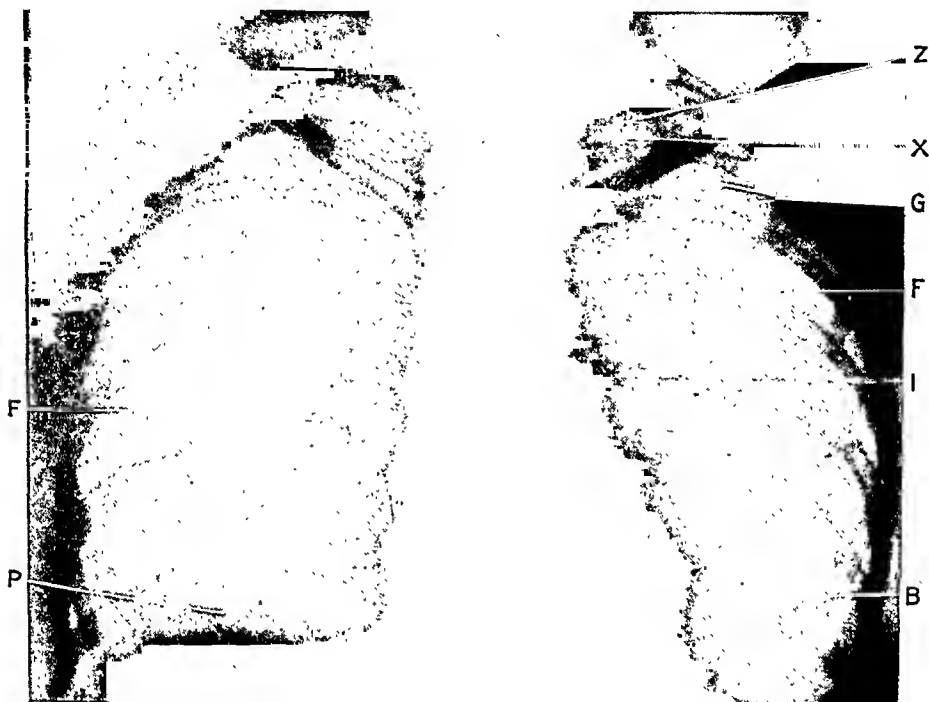


FIG 15.—This is one of the most classical plates of early tuberculous infiltration that I have made, but unfortunately is it very difficult to reproduce for publication. The original plate shows the following detail very distinctly: Diminished aëration of the left upper lobe; *B*, heart normal in size, shape, and position; *F*, thickening around both roots, more typically tuberculous where it extends out along the bronchus on the left side, having the appearance of the rough bark of a tree. The air cells supplied by this bronchus, and only these air cells, are infiltrated with miliary (*X*) and conglomerate (*Z*) tubercles giving the mottled appearance so typical of tuberculous infiltration of the lung (*G*). Family history: Father and mother died of tuberculosis. History: No cough, expectoration, or physical signs; loss of five pounds in weight and loss of sleep in the month of May, neither of which would ordinarily cause a patient to consult a physician for tuberculosis. The diagnosis of this case was made solely on the radiographic examination; the patient was treated accordingly, and the last I heard was perfectly well.

Chronic, fibroid consolidation is usually limited to one lung or part of one lung (Fig. 13). The consolidation may or may not be very dense and there is retraction of that side of the chest; frequently the ribs are drawn together, which gives a lateral curvature to the spine. The diaphragm is retracted and the heart is drawn to the affected side, or some say it is pushed over by the emphysematous lung on the opposite side.

Old calcified tubercles (Fig. 20, *I*) are most frequently seen at the root of the lung; they may be in the glands or in or around the walls of the bronchi, particularly the right descending bronchus and its branches (Fig. 17, *I*); they are usually the results of infection during childhood. When seen at the apex (Fig. 21, *I*) or at some other part of the lung, they are then the result of an old healed process probably of more recent origin, and are readily differentiated from the exudative or productive tubercle of an active or recently active lesion (Fig. 15, *X Z*).

Tuberculous infection may involve the lungs in the following ways:

CLASSIFICATION II.

<p>Parenchymal involvement; may be exudative or productive, or a combination of both, and may have gone on to the stages of necrosis.</p>	<p>1. Limited to one or both apices (Fig. 3). 2. Limited to one lobe or the entire lung (Figs. 1 and 2). 3. Or it may involve part of both lungs (Figs. 8, 9, and 10).</p>
<p>Bronchial or peribronchial; may be exudative or productive, or both, but the productive process usually predominates.</p>	<p>1. Radiating in character from the root to the apex in adults (Fig. 1); to the base in children—old calcified (Fig. 17). 2. Bronchi alone may be involved (Fig. 14). 3. Bronchi and air cells supplied by bronchi may be involved (Fig. 15), with isolated (Fig. 15, <i>X</i>) or conglomerate tubercles (Fig. 15, <i>Z</i>). 4. Fibrous growth from the root without individual tubercles—not positively tuberculous (Fig. 14). 5. Bronchi may be normal in size with thickened walls, as in Fig. 15, <i>F G</i>; they may be dilated and filled with pus and exudate (Fig. 9, <i>K</i>), or empty—bronchiectasis (Fig. 9, <i>K</i>).</p>
<p>Root involvement may be glandular, bronchial, or peribronchial, either fibrous or calcareous.</p>	<p>1. Glandular may be circumscribed with clear cut edges (Fig. 16, <i>F</i>). 2. Groups of small glands connected by fibrous tissue which extends out along bronchi (Fig. 10, <i>F</i> and Fig. 17, <i>F</i>). 3. Bronchial or peribronchial thickening around the larger bronchi, without thickening of the root itself and without infiltration of the surrounding tissue (Fig. 18, <i>F</i>). 4. Or the walls of the larger bronchi may be thickened and seen on cross sections giving circles or the figure eight (Fig. 19, <i>F</i>). 5. This thickening may be shown in the active stage (Fig. 10, <i>F</i>), which is readily differentiated. 6. From the old calcified tubercles of a healed lesion (Fig. 20, <i>I</i>). Root (Fig. 20). Branch of descending bronchi (Fig. 17, <i>I</i>). Apex (Fig. 21).</p>
<p>Tuberculosis may be differentiated from</p>	<p>Dry pleurisy. Pleurisy with effusion. Empyema. Carcinoma. Aneurism.</p>

The exudative, productive, or combination of both processes may involve the parenchyma of the lungs, and it may go on to the

stage of necrosis. It may be limited to one or both apices (Fig. 3), or one lobe (Figs. 5 and 6), or it may involve one entire lung (Fig. 13), or part of both (Figs. 8 and 9).

I have never seen a tuberculous lesion of the parenchyma without a typical tuberculous infiltration around the root. In some cases it is difficult to show the connection between the two processes, but with improved technique and more pathological radiography I think that it will be established that all tuberculous lesions begin at the root and extend to the parenchyma.

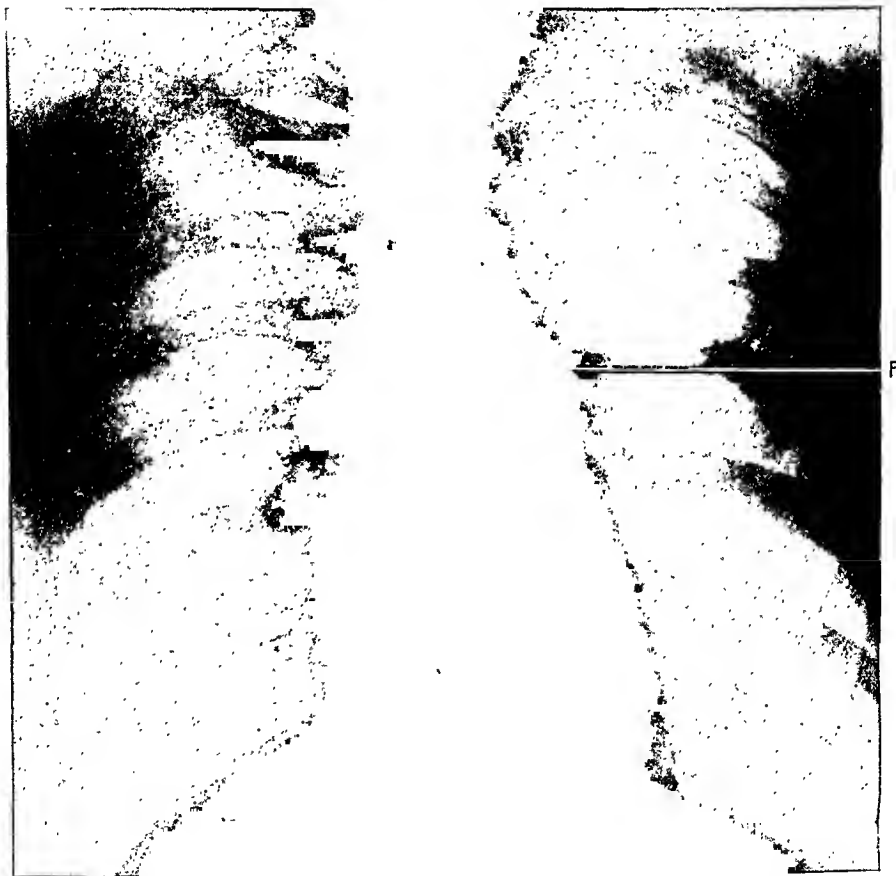


FIG. 16.—Shows a circumscribed gland (*F*) on the left side, opposite the tip of the third rib.

Radiographic examination of incipient cases indicates that in a very large percentage of cases the lesion at the root is more extensive than the parenchymal lesion; and so frequently radiograms show a distinct lesion at the root with no parenchymal involvement that it is reasonable to assume that it extends from the root to the parenchyma. Radiating from the root to the apex in adults (Fig. 14), and to the base in children, may be seen infiltration in and around the walls of the bronchi, giving the appearance of the rough bark on the

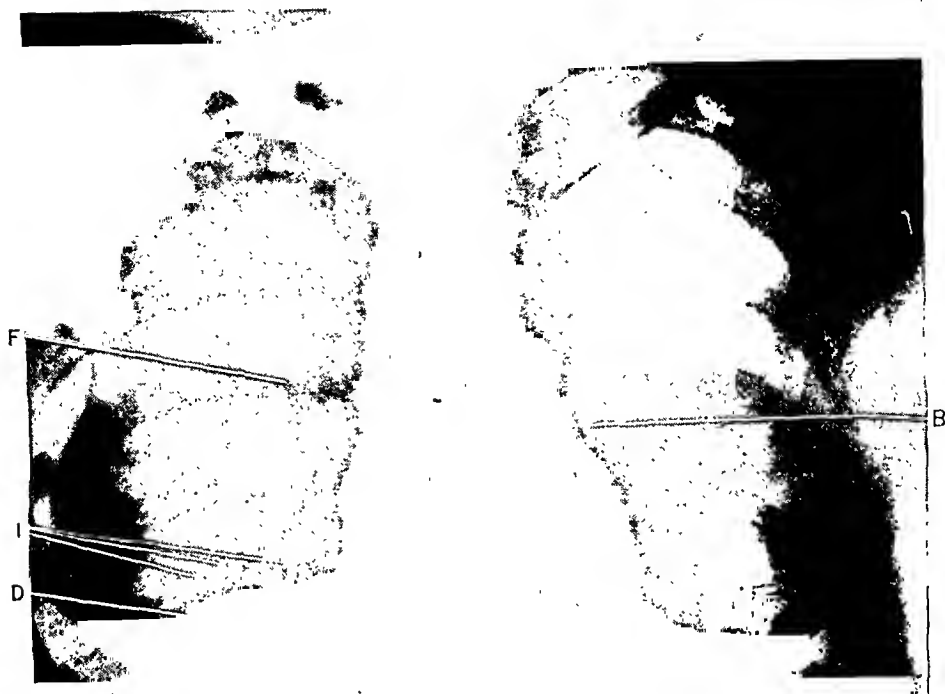


FIG. 17.—Illustrates typical acute infiltration around the root and old calcified tubercles (*I*) around the right descending bronchus, with localized retraction of the diaphragm (*D*); *B*, heart normal; *F*, acute infiltration around the root; *D*, diaphragm, localized retraction in the area of old calcified tubercles (*I*)



FIG. 18.—Illustrates infiltration around medium size bronchi like a fan, without infiltration around the root. Posterior view: *A*, normal markings of the lungs show distinctly; *FG*, bronchial or peribronchial infiltration of medium size bronchi spreading out like a fan.

branches of a tree (Fig. 15, *F, G*); the air cells supplied by these bronchi are infiltrated with isolated (Fig. 15, *X*) or conglomerate (Fig. 15, *Z*) tubercles. The process has the appearance of a tree budding in the springtime. There may be a diffuse fibrous growth extending from the root, without individual or conglomerate tubercles, giving the appearance of a general fibrous thickening and lack of aëration (Fig. 14, *G*). I am very cautious about making a diagnosis of tuberculosis in those cases in which the typical tubercles are absent. The bronchi may be normal in size (Fig. 15, *F, G*),

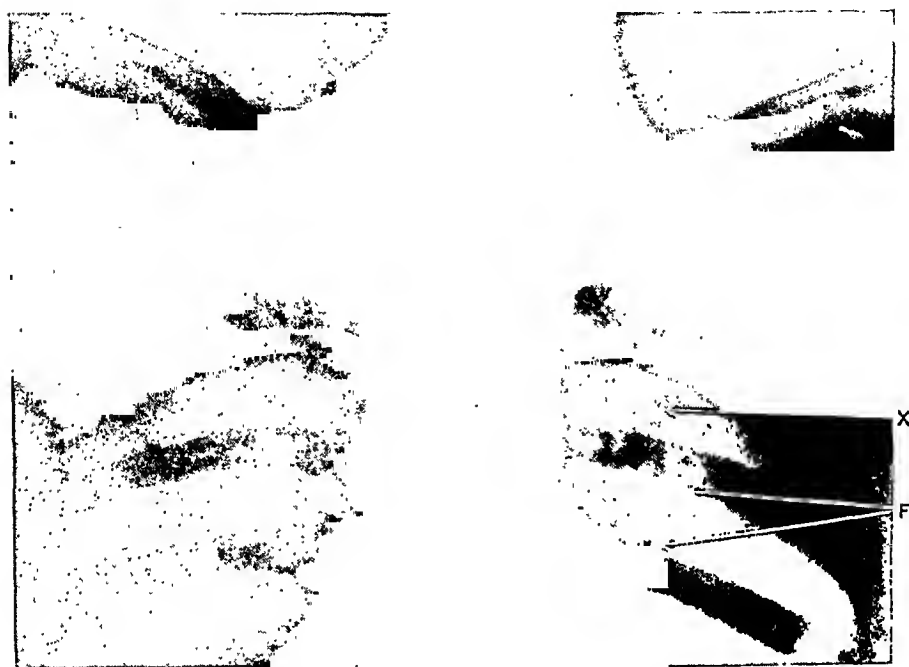


FIG. 19.—The only symptom was hemoptysis. The physical signs were absolutely negative. This was a test case examined for admission to the Saranac Sanatorium, and there were absolutely no physical signs of tuberculous infection. Repeated radiographic examinations showed a typical figure-of-8 thickening (*F*) around the root, surrounded by scattered tubercles (*X*). The patient was sent to Saranac solely on the radiographic findings; reacted to tuberculin injections, and later developed physical signs over this area, but recovered rapidly.

or they may be dilated and full of exudate (Fig. 9, *K*), or empty (Fig. 9, *K*). Tuberculous infection around the root of the lung may involve the glands (Fig. 16), the bronchi, or it may be peribronchial in character.

Glandular enlargement may be circumscribed with clear-cut edges (Fig. 16, *F*), but more frequently there is a group of small glands connected by fibrous tissue which extends out along the bronchi and bloodvessels (Figs. 10, *F*, and 17, *F*). There may be infiltration in or around the larger bronchi without thickening at the root and without parenchymal involvement (Fig. 18, *FG*)

The walls of the larger bronchi may be infiltrated, and when seen on cross section give the appearance of circles or figure "8" (Fig. 19, *F*), and may be surrounded by a few isolated tubercles (Fig. 19, *X*), which would indicate activity. The infiltration of the root may be shown in the active stage (Fig. 10, *F*), when it has a soft



FIG. 20.—This radiogram illustrates a group of calcified tubercles in the walls of the large bronchi, causing hemorrhage on exertion. History: During or immediately after a game of basket-ball this girl, who had previously been perfectly healthy, had profuse hemoptysis without other symptoms, and with absolutely no physical signs to indicate a tuberculous process. The girl consulted a physician who has all doubtful cases of the chest radiographed, regardless of whether he gets physical signs of tuberculous infection or not. A series of these plates showed a group of calcified tubercles around the root of the right lung, in close proximity with the base of the heart, and I believe that, either from forced heart or respiratory action, these tubercles scratched through the membrane, and caused profuse hemoptysis. The physician who referred the patient to me made a positive diagnosis of tuberculosis, based entirely on the radiographic findings. The attending physician, in another vicinity, ridiculed the diagnosis, because of the absence of physical signs. Several months later physical signs developed and the diagnosis was confirmed. The girl went to Colorado, and the process was checked. This is only one of several cases in which there was hemoptysis on exertion, with no physical signs. Swimming and basket-ball are the exercises that have caused the hemoptysis in most of these cases.

diffuse appearance, which is readily differentiated from the old healed calcified lesion (Fig. 20, *I*), which is usually the result of infection during childhood.

Healed tuberculous processes vary in their appearance according to the variety and extent of the lesions and the time that has elapsed since they were active. The exudative process when checked shows a much greater tendency to resolve than is generally supposed, and

all that may remain of quite an extensive exudative process is a few scattered calcified tubercles (Fig. 21, *I*).

The productive process tends to a fibrous thickening that sometimes seems to resolve or at least diminish in density. This is

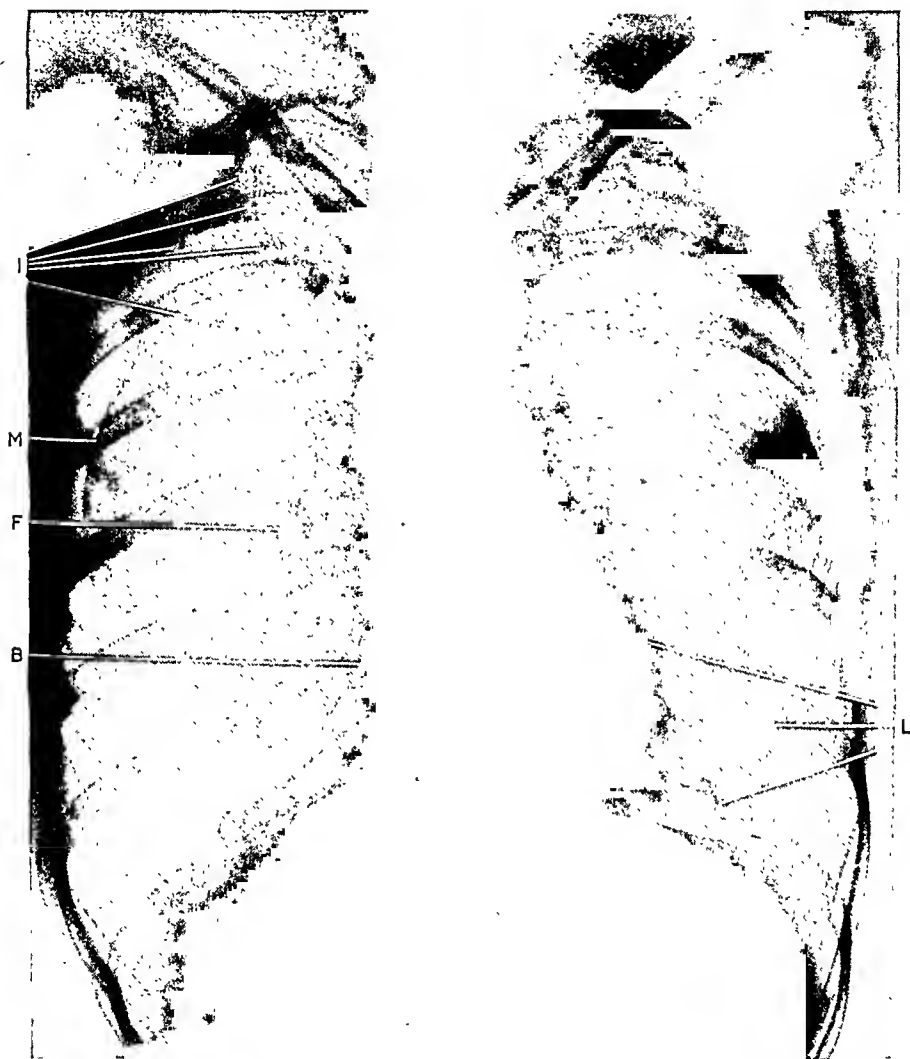


FIG. 21.—This illustrates a normal chest except a group of old calcified tubercles at the right apex, which are all that remain of quite an extensive process that was active nineteen years previously. No physical signs were apparent. Normal markings of the lungs show distinctly. *B*, heart normal in size, shape, and position, diaphragm normal; *F*, thickening around the root (old process); *M*, mammary gland should not be mistaken for consolidation; *L*, calcified costal cartilages should not be mistaken for calcified tubercles; *I*, old calcified tubercles at right apex.

probably a mixed process; and the exudate resolves and the fibrous process contracts. The old calcified lesions are found most frequently around the root (Fig. 20, *I*) and the right descending bronchus

(Fig. 17, *I*), and are the result of infection during childhood. These are present in a very large percentage of cases, thus corroborating the cutaneous reaction made by von Pirquet, referred to early in this paper.

The differentiation of tuberculosis from other pulmonary lesions may be definitely made solely by the radiographic examination. Dry thickened pleura may be differentiated from tuberculous infiltration by the smooth, homogeneous appearance and the normal markings of the lung showing through. Pleurisy with effusion has a smooth, homogeneous appearance shading off gradually to the density of the lung at the upper surface of the fluid. Empyema, especially if encapsulation, is of equal density throughout, with clear-cut edges, and it does not have the mottled appearance of tuberculous infection. Carcinoma has an appearance similar to the fibrous consolidation, but it has more of a nodular appearance, and unless complicated by tuberculosis no individual or conglomerate tubercles are present. Aneurysm has to be differentiated only from mediastinal glandular involvement, and this is sometimes difficult unless a fluoroscopic examination is made to see whether the tumor pulsates.

Considering the large percentage of cases in which tuberculosis is found at autopsy when only a few gross sections are made of the specimen, and the fact that the Germans say that 98 per cent. of all adults have or have had a tuberculous lesion of the lung, and that 93 per cent. of children reacted to the cutaneous tuberculin test, it is not a question of who has tuberculosis, but what is the variety and extent of the lesion and is it active or inactive.

If pulmonary tuberculosis can be diagnosticated radiographically as early and accurately as now appears, and if one can state with a reasonable degree of certainty the variety of the lesion and whether it is active or inactive, and can determine with absolute certainty whether the process is advancing, held in check, or resolving, it seems that the question of the diagnosis of incipient pulmonary tuberculosis is solved.

THE MEDICAL ASPECTS OF THOSE TOXEMIAS OF PREGNANCY WHICH TEND TOWARD ECLAMPSIA.

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In the process of childbearing certain physiological activities are inaugurated which, when successfully completed, introduce into the world an independent being. Some women are never so well as during, and for a time following, pregnancy; in others, anatomical

and functional aberrations arise which may be characterized as slight, moderate, or severe; in yet others, happily few, the results are abortive and destructive. With a physiology stimulated to beneficent constructive activity, on the one hand, and perverted to the most pronounced pathology, on the other, the investigator may well seek for the heretofore elusive essential causative element. The physiological features interest us as scientists; the pathological problems deeply concern us as physicians. Perhaps future discoverers, advancing beyond the realms of speculation, may demonstrate that, as the result of incomplete or inharmonious complemental union of the attracting centrosomes of the spermatozoön and ovum, some substance is developed, increased, and intensified by subsequent foetal growth, which, entering the maternal circulation through the syncytium, is deleterious to the gravid woman, and is the primary cause of the toxemias of pregnancy. Without attempting to review the facts upon which the opinion is predicated, we may, for the present, safely assume that the primary offending material is elaborated within the foetus and its adnexa; that it is specific in character; that it is responsible for certain maternal lesions and disorders, as hepatic, renal, and others; and that secondary toxins consequent upon such pathology play important roles in the late toxemias which lead toward eclampsia.

Shortly after impregnation, at a period probably coincident with the establishment of maternal and foetal circulatory connection, certain special symptoms arise. Of these, the peculiar vomiting of pregnancy is the most striking. Ordinarily it is of such character and degree that it gives rise to no apprehension upon the part of either patient or physician. In the comparatively rare cases, however, it attains the dignity of hyperemesis—the so-called pernicious vomiting of pregnancy—and may become an element of great danger. In such cases the symptoms are unlike those of any other morbid condition, and the anatomical changes are quite special. The distressing features of the nausea and vomiting need not be depicted; the ejected aqueous liquid, mixed with mucus and bile, is notably ammoniacal and acrid. The scanty urine is dark, and heavy with solids; the well-maintained total nitrogen output includes a notable, or even a remarkably large, proportion of ammonia; possibly acetone and diacetic acid may be present; only as the danger line is passed do albumin and casts appear. In desperate cases hemorrhages may occur, with marked pallor; the blood pressure declines, prostration is profound, and hebetude supervenes; there may be slight, but very rarely is there deep, jaundice, although there is almost always tenderness over the liver. Post mortem there is found, distinctively, necrosis of the central portions of the hepatic lobules, with consecutive cellular degenerations. The kidneys are large, soft, and pale, with slight tubular and possibly other parenchymatous alterations. The condition manifests itself during the third and fourth months, appearing only rarely at a later period of pregnancy.

It may be well at this time to consider cursorily certain subjects which are of more or less importance in the process of childbearing: Thus, there is pituitary hyperplasia during pregnancy, but it is probable that the special secretion of this gland is required in uterine development, and in its final great physiological feat. It is a matter of common observation that thyroid activity is stimulated by menstruation and pregnancy, and it has been alleged that the markedly athyroidic subject is especially liable to the late toxemia which tends toward eclampsia. In such conditions benefit may be noticeable after the administration of thyroid extract, but this may be due to the induced lowering of the blood tension, and not to any specific action. Removal of the parathyroids is often followed by tetany, and certain animal experiments appear to show that parathyroid feeding may prevent eclampsia, but further evidence is required before any great importance is attached to these studies. The connection between adrenal hyperplasia and the increase in blood pressure and impending and present eclampsia has not been worked out.

In the toxemic state preceding eclampsia there may be found, often if not regularly, cerebral oedema, with high tension of the cerebrospinal liquid. If convulsions have occurred, there are, usually, numerous minute extravasations of blood scattered throughout the brain, with large hemorrhages into the ventricles.

Mention has been made of the hepatic lesions found in connection with, and apparently characteristic of, the pernicious vomiting of pregnancy. In the later toxemias the liver presents anatomical changes equally distinctive. Essentially these consist of hemorrhages in and about the portal spaces, cloudy swelling, fatty degeneration, and necrosis of the hepatic cells. In some instances the microscopic findings are such as to lead to the plausible conclusion that the liver of earlier pregnancy had been carried along to the eclamptic period, with the hemorrhages as a terminal addition. Macroscopically there may be more or less extensive hemorrhages beneath the capsule and throughout the organ. During life the liver is tender and demonstrably enlarged. Slight icterus may be noticeable; profound jaundice is very rare. Acute yellow atrophy of the liver is encountered very much more frequently in pregnant women than under any other circumstance, but the large incidence is clearly due to the inviting field presented, and not to a specific cause connected with the gravid state. It has been assumed, in some quarters, that there is a special "liver of pregnancy," characterized by a definite insufficiency, manifesting itself most noticeably by the incomplete conversion of ammonia into urea, but if this is true the demonstration must be difficult.

In practically all cases of eclampsia there are renal changes which appear identical with those of acute nephritis. The kidneys are large, pale, and of diminished consistency. Microscopically the alterations are found almost exclusively in the cortical convoluted

tubules, with slight glomerular involvement. Rarely are more extensive changes observed, unless the patient is also the subject of a chronic nephritis. Prompt anatomical recovery is the rule. This condition, known as the "kidney of pregnancy," often develops rapidly, and is accompanied by scanty and albuminous urine, casts, etc.; occasionally anuria supervenes.

The urinary excretion in pregnancy has been the subject of elaborate and painstaking investigation, as well merited by its importance, for it is here that the first resonant note of alarm is sounded. It is true that to the attentive observer there will be disclosed other and earlier indications of the gathering storm, yet by common consent, and with good and sufficient reasons, the appearance of albumin in this liquid has been long considered the line beyond which security does not dwell. The simple fact of its presence is sufficient evidence of the proximity of danger; the manner of its advent is dramatic. General acceptance will probably be given to the statement that, as a rule, the urine of the gravid woman is, compared with that of health, lighter in color, diminished in specific gravity, deficient in chlorides and urea, while the sulphates are increased, possibly with the appearance of indican. To this rule there are exceptions, the output of urea and salts being well maintained or exceeding the normal, but I must confess that, within the limits of my observation, these have not been as reassuring as might be inferred; indeed, to me a dark and markedly acid urine, rich in urea and other solids, is a disturbing circumstance, leading to concern or anxiety. It is probable that reduplication of my own experience is responsible for the widespread mild distrust within the medical profession as to the value of frequent and careful examinations of the urine in these cases. Nevertheless, a moment's consideration of the subject should disclose the weakness of such a position. Granting that albuminuria sometimes suddenly makes its appearance in cases showing no previous deviations from the urine of normal pregnancy, or of health, the significance of its advent is not diminished in the least; acute nephritis, the "kidney of pregnancy," and a grave toxemia are present.

Œdema has long been observed in connection with the albuminuria and eclampsia of pregnancy. Manifest œdema is obtrusively prominent, and is easily recognized; but this is preceded by an overful state of the intercellular tissue-lymph spaces, a condition which may be called occult œdema. In this variety the normal laxity of the soft tissues gives place to increased resistance; there is a notable sense of exalted tension, which is subjectively perceptible to the patient and objectively detectable by the examiner; the blood pressure is raised, sometimes to a great height; the eyes are prominent, and the face, trunk, and extremities are noticeably plump; there is no pitting upon pressure, because the resiliency of the areolar tissues is maintained; manifest œdema is imminent. In this condition there is

advancing grave disturbance of the delicate balance existing between the vascular, lymphatic, and extravascular tissue-lymph circulation, and with this probably begins the danger period for the gravid woman. To the burden of the incoming foetal toxins there is now added the accumulating toxic cellular waste of the pregnant woman herself. So far as the imminency and extent of the risks of eclampsia are concerned, there is probably little choice between occult and manifest oedema; there is a larger accumulation of deleterious matters in the latter, but the system is partly protected by the short-circuiting of the extravascular circulation.

If there is any blending of the toxemia of gravidity and uremia in the genesis of eclampsia, here is the ground upon which they must meet. There may now appear upon the scene high blood pressure, tinnitus, amblyopia, muscular twitchings, etc., followed by convulsions or coma, all of which are prominent symptoms of uremia. However, should death occur, there is this notable anatomical difference, namely, that whereas hepatic, pulmonary, and, especially, massive cerebral hemorrhages are uncommon in simple uremic convulsions, they are the rule in eclampsia. Nevertheless, after a careful review of this question, I am, tentatively at least, of the opinion that in such cases there is added to the primary toxemia of pregnancy a secondary uremia, although I am not prepared to urge strongly its acceptance upon others.

For many years I have been deeply interested in the behavior of the extravascular circulation, and the composition of the tissue lymph in cases of occult and manifest oedema. In these cases there is lymphatic insufficiency; tissue-lymph circulation is impeded or short-circuited; nutritive material fails to reach freely the various cells of the body; waste products of cellular metabolism are not adequately discharged; effete and toxic substances accumulate in this liquid. Remedially, considerable or large quantities of this tissue lymph, heavily laden with cellular debris, deleterious toxins, and saline accumulations, may be readily removed (measured and analyzed), and with evident symptomatic and fundamental benefit to the patient. I am of the opinion that the usefulness of this procedure may be enhanced by early recourse to it, at a time, indeed, which will materially anticipate eclamptic imminence.

That prominence may be lent to some of the practical points above mentioned the pertinent details of an illustrative case are given:

A lady, of general good health, aged thirty-four years, who had had scarlet fever at thirteen years, and gave successful birth to a child, after a short period of albuminuria and threatened eclampsia, at twenty-eight years, entered upon a second pregnancy early in December. At the end of the first month she was in excellent condition; the eye grounds were normal; there were no evidences of cardiac insufficiency; the systolic blood pressure was 130 mm. Hg.; the urine was normal in quantity and character; there was moderate

nausea and vomiting. The vomiting ceased in the fourth month; the blood pressure remained unaltered; the urinary findings were practically unchanged, with the exception that the sulphates gradually increased in amount, and indican appeared at the end of the third month. At the end of the sixth month a few hyaline casts were detected in the urine. One week later there was an abundant albuminuria. The blood pressure quickly rose from 135 to 160. Occult oedema was present. During the following week the average daily excretion of urine was 1600 c.c., with an intake of about 2000 c.c. of liquids. The urea output ranged between 43 and 17 grams per day. The chlorides were about normal, but the phosphates and sulphates were reduced. The albumin varied from 4 per cent. to 17 per cent. Only rarely were a few hyaline casts found. There were flashes of light before the eyes, amblyopia, headache, sleeplessness, restlessness, nystagmus, general nervous tension, muscular twitchings, etc. Foetal movements, if present, were slight and not objectively noticeable. During the next three days the blood pressure rose to 185; the urea excretion varied from 15.4 to 18 grams daily; the chlorides rose to volumetric percentages of 37 to 45; the phosphates and, especially, the sulphates were reduced; albumin was present to from 27 per cent. to 38.5 per cent. by volume; hyaline, granular, and blood casts were abundant. During these three days there was drained away more than 6500 c.c. of intestinal serum, having a specific gravity of from 1012 to 1018, acidity of 10°, urea to 0.2 per cent., chlorides to 18 per cent., and sulphates to 10 per cent. by volume. During the following three days the urine continued scanty, with urea from 14 to 19 grams per day; the chlorides rose to the great height of 62 per cent. by volume; albumin was present to 42 per cent., 39 per cent., and 20 per cent. on the respective days; casts were found in rapidly diminishing numbers; the blood pressure declined to 142; the sleeplessness, restlessness, nervous tension, muscular twitching, and other symptoms of eclamptic imminence subsided. During the following week the urine gradually approached the normal in character, with a reduction of the albumin to traces, and the casts to occasional findings; the blood pressure fell to 132, which is about normal for this patient. At the end of this period a shrunken seven months' child was born, apparently having been dead for several days. Recovery was prompt and complete. The management included confinement to bed; bleeding to 600 c.c.; sweating; reduction of the food to liquids little more nutritious than water; the evacuation of serum, via the intestines, to the extent mentioned, by the use of elaterin, administered in the manner advocated in another publication.¹

It will have been noticed that studied care has been exercised in avoiding any reference to those large and important obstetrical problems which are involved in the management of those toxemias of

¹ Jour. Amer. Med. Assoc., 1909, Iiii, 1796.

pregnancy which tend toward eclampsia. Upon these I have no views to express, but it should not be assumed that, in presenting some of the medical aspects of these conditions, I am insensible to the primary lesson to be learned from a proper consideration of the fact that evacuation of the uterus upon the earliest appearance of danger will promptly save almost all these women, with, probably, but little difference in the child mortality. Neither should it be inferred that, in calling attention to a method of ridding these patients of a portion of the toxic load under which they may be staggering, I am advocating it as a measure to be substituted for forcible delivery. My object will have been attained if the subject has been presented in such manner as to indicate clearly that the primary specific toxic agent is of foetal origin, and probably attacks the pregnant woman by way of the placenta; that certain distinctive anatomical changes are induced in the liver and kidneys; that these are followed by tissue-lymph circulatory insufficiency, with consequent accumulation of toxic substances in this liquid, occult or manifest oedema, and eclamptic imminency; that by draining off a portion of the excess of tissue lymph, heavily laden with deleterious and dangerous toxic substances, cellular nutrition may be promoted, many of the prominent symptoms of eclamptic imminency relieved, and the patient benefited.

DISTURBANCES OF THE THYROID SECRETION IN NORTHERN MEXICO.

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WE need a short comprehensive term for a number of interesting conditions ranging between the extremes of myxoedema and exophthalmic goitre. Levy, Rothschild, and Huchard have entitled a recent paper "Thyroid Instability."¹ This is short enough, but seems to refer more to a functional trouble, whereas the symptoms are generally caused by definite progressive changes in the gland.

There are towns in the mountainous state of Sonora where goitre is endemic, and it would seem that northern Mexico is a splendid field for the study of these disorders. A large proportion of the women have enlarged thyroids, and cases of moderate thyroidism are seen constantly.

Haller, in 1730, quoted the suggestion of Ruysch that the "blood-vessel glands" elaborate some substance that is thrown into the

¹ Bull. de l'Académie de méd., May 18, 1909.

blood current. A hundred years later, Bernard gave us the term "internal secretion," and since then a host of able experimenters have been at work in this field. Although cretinism and myxœdema are now easily cured, especially in the early stages, there is some cause for disappointment when we consider that, in the absence of an especially skilful surgeon, the physician today can do little more for a patient with exophthalmic goitre, the commonest and severest of these disorders, than he could in the time of Parry, Graves, and Basedow.

Although we are now recognizing certain symptom-complexes as of thyroid origin, we have much to learn as to the direct causation of the separate symptoms. Many of them are plainly due to the accelerated or retarded metabolism, as the case may be, and in hypothyroidism, malnutrition of the nervous system, muscles, and skin is a prominent factor. Some of the symptoms of thyroidism are those of angioparalysis, and angiospasm may be present in the opposite disorder. It is also entirely probable that the thyroid secretion is composed of various elements, and that some may be diminished or absent, while others are normal or overactive. This can help us to understand those puzzling cases in which symptoms of hypothyroidism and hyperthyroidism are plainly present at the same time. Pitfield² suggests that the thyroid secretion may be almost as complicated as the blood plasma, with its different functions. Another explanation offered in these cases is that an organ functioning defectively is liable to go to the opposite extreme in the effort to restore its balance.

Myxœdema, exophthalmic goitre, and cretinism have been recognized for many years, but of late our attention has been drawn perhaps more to the incomplete forms—"formes frustes" of the French. With the better understanding of these disorders, we will be able properly to classify many cases of so-called neurasthenia, hysteria, rheumatism, etc., and we will more often recognize an inefficient thyroid as a complicating factor in obscure cases. Frequently now the diagnosis has to be proved by the marked relief obtained from thyroid medication. And even this is not conclusive evidence, as shown by the articles that have appeared, claiming thyroid as a cure for most of the ills to which flesh is heir. If its usefulness in some unrelated disorders be confirmed by time and experience, further channels of research will be opened up.

Thyroid affections occur much more frequently in women than in men—thyroidism in the young, and hypothyroidism in the middle-aged. The trouble often seems to date from some infection such as grippe. Incomplete myxœdema appears generally about the time of the menopause, and often seems to cause the annoying symptoms of that epoch. According to Nichols, the disease

² AMER. JOUR. MED. SCI., 1907, cxxxiv, 859.

delays the menopause, but in many cases it seems to cause first a tendency to severe uterine hemorrhages, and then an early climacteric.³ Pitfield believes it to be one of the penalties of child-bearing, but it does occur in the unmarried and the nulliparous, and we need more statistics on the subject.

The relation between the thyroid and the reproductive organs, especially of women, has been known since ancient times. The gland often enlarges at puberty and during menstruation and pregnancy; the genitals do not develop in cretinism; pregnancy may cause temporary disappearance of myxedema, etc. The term "paroxysmal hypothyroidism" has been applied to a condition in which the harsh and uncontrollable voice, and other symptoms of incomplete myxedema recur with each menstrual period. Cases illustrative of these facts can be found in recent articles by Elliot⁴ and Pinard.⁵

One of the most prominent symptoms of all these disorders is asthenia, which causes a giving way of the knees quite characteristic of hypothyroidism. Osler's text-book mentions it as a symptom of Graves' disease. It is probably due to the weakness alone and is commonly experienced by athletes after an exhausting race. The weakness would be bad enough, but these patients generally take on flesh, which greatly adds to their discomfort. It would seem sometimes that the improvement noted in a given case could be due simply to the loss of weight caused by the thyroid medication. The increase in weight is one of the results of the sluggish metabolism, which, in its turn, is due to a lack of the accelerator effect of the thyroid secretion. The constant chilliness and coldness of these patients may be due to the same cause and to the anemia and dryness of the skin. One of the characteristic features is the presence of triangular pads of fat over the clavicles. The left one is often hyperesthetic.

The characteristic facial expression has been described as one of sorrowful fatigue. The intelligence may be slightly impaired, and there are hallucinations, especially of hearing. Tinnitus aurium is common. One of the most constant complaints is of anginoid pain under the left breast. This may possibly bear some relation to the heart changes which are generally present. Headache and backache are common, as are rheumatoid pains in all the larger joints. It is interesting to note here that marked changes are found in the epiphyses of the long bones of cats after thyroidectomy,⁶ and that there is a retardation of the calcification of the cartilages in cretins, as shown by the x-rays.⁷ It is not impossible that similar

³ Jour. Amer. Med. Assoc., 1909, lii, 1162.

⁴ AMER. JOUR. MED. SCI., 1907, cxxxiv, 390.

⁵ Ann. de gyn. et d'obstét., May, 1909, 257.

⁶ Mit. aus d. Grenzgeb. der Med. u. Chir., 1907, xviii, 329.

⁷ AMER. JOUR. MED SCI., 1909, cxxxvii, 496.

changes occur in hypothyroidism, and that poorly nourished and painful epiphysees simulate rheumatic joints.

The skin occasionally has an olive tint, and it is almost always dry and scaly. The hair is often prematurely gray, and on account of the dryness and brittleness it soon becomes scanty on the eyebrows, axillæ, and back of the neck. Sweating, when present, may be localized to some one part of the body. Transitory oedema may be seen on the face and extremities, hence the frequent diagnosis of nephritis in these cases.

The heart is often somewhat dilated, and there are murmurs, due probably, in most cases, to relative cardiac insufficiency. As a rule, the dyspnœa present is out of all proportion to the heart findings. The pulse is rarely over 100, and the blood pressure is liable to be high. The teeth are generally carious. The buccal mucous membrane is often swollen so as to show marks of the teeth.

The thyroid may be too small to be palpated, or there may be a larger goitre. The symptoms depend not on the size of the gland, but on the amount of damage done to the secreting parenchyma. The voice often becomes harsh, and the patient loses control over it. It is interesting to note here that Pineles⁸ has observed these spasms of the larynx after operative injury to the parathyroids. The blood generally shows some anemia and a lymphocytosis. There is some poikilocytosis, and in severe cases there are normoblasts. The lymphocytosis is found also in thyroidism. Transient albuminuria is common.

The following history is that of a fairly typical case of incomplete myxoedema:

CASE I.—Mrs. O., Mexican; widow; washerwoman; aged forty years; complains of anginoid pains under the left breast, and dyspnœa on exertion. She was healthy as a child. Menstruation began at fifteen, and was scanty, lasting three days. Married at nineteen, she has had three healthy children, the last nine years ago. There never was any hemorrhagic tendency.

The present complaint dates back four years to an attack of bronchitis. The cough soon disappeared, but she has been growing so weak that she can get up a hill only with difficulty, and has had to restrict her work to ironing. Her knees will often give way from under her on the street, causing her great embarrassment. There have occasionally been tremor of the hands, and nocturnal attacks resembling asthma. She is quite intelligent, and her memory has remained good. There are hallucinations of hearing and tinnitus aurium. Besides the pain in the left side, which annoys her most, she often has severe temporal and occipital headaches, rheumatoid pains in all the larger joints, and obstinate backache.

⁸ Wien. klin. Woch. April 30, 1905, xxi, 641.

She has become stouter in later years. She always feels cold, and sometimes an entire limb feels numb and frozen. There is formication over the left breast. The skin has been dry and scaly several years; she became gray at thirty, and the hair is brittle and falls out easily. The eyelids are sometimes puffy. There has never been any œdema of the legs. Appetite and digestion are good, and there is no constipation. Since girlhood her voice has become harsh and unruly during menstrual periods, and it is that way most of the time now. For the last seven years menstruation has been more profuse, lasting eight days, and occasionally occurring twice in the month.

The patient is short and stout, and looks prematurely gray. The buccal mucous membrane is œdematous and plainly shows the prints of the teeth on tongue and cheek. The circumvallate papillæ are greatly hypertrophied. The uvula is œdematous. Hearing is good. The thyroid gland is palpable but very small. There are two large triangular pads over the clavicles. The left one is the more prominent, and is painful and sensitive on pressure. The lungs are normal. The heart shows slight enlargement to the left, and there is a murmur indicating some incompetence of the mitral valve. The pulse is regular and 60 per minute. The palpable arteries are in good condition. The deep reflexes are slightly exaggerated, but the abdominal, epigastric, and plantar cannot be elicited. Sensation is not impaired, and the musculature is good. The fingers are short and thick, resembling those of advanced myxœdema. The urine contains neither albumin nor sugar. The blood is quite normal except for 70 per cent. of hemoglobin and a moderate poikilocytosis. The polynuclears are 64 per cent.; the lymphocytes, 22 per cent.; the large mononuclears, 14 per cent.; no eosinophiles were seen.

Fifty two-grain capsules of desiccated thyroid gave complete relief from all the symptoms in a month. She had lost weight, was brighter, the pains and asthenia were gone, and the heart murmur disappeared. The right fat-pad disappeared, and the left was much less noticeable. During the next few months she took a few more capsules, and over a year has now passed without recurrence of symptoms.

The interesting features of this case are: The paroxysmal hypothyroïdea, which she has had throughout her sexual life; grayness at the age of thirty; tremor, which is more a symptom of thyroidism; slow pulse; and the hypertrophy of the circumvallate papillæ, which is possibly of some significance when we remember the close embryological relation of the base of the tongue and the middle lobe of the thyroid. I have noticed in several cases that the skin reflexes are absent, while the deep reflexes are normal. With sensation practically unimpaired, it is still possible that the reflex path is blocked in the abnormal skin. This is a point of some interest, and perhaps

diagnostic import. Many of the reports consulted in regard to this particular do not mention the reflexes at all. Howard⁹ says that the superficial reflexes are sometimes diminished and rarely absent. Many things have been rare only until attention was directed to them.

The next case is very unfortunately incomplete, as the patient left before the symptoms of hypophyseal involvement could be thoroughly studied.

CASE II.—A. R., Mexican; a cook; aged thirty-five years; a widow, complains of pain radiating from her feet to her hips. She enjoyed fair health up to a month ago, when she had la grippe. Menstruation was regular and uneventful until it stopped at the age of twenty-nine. A year later she began to get gray. She was married only seven months, and never conceived. Her voice has lately become coarse and harsh, and is all the more noticeable to her, as she used to sing with a good soprano before. She has been unable to do much work for the last two weeks on account of pain in the legs. She gets out of breath and has a coughing fit on climbing a hill. There is no cough at other times. Her knees give way when she is tired. Her memory is very bad, and she has hallucinations of hearing. At times she has been very deaf. Some time ago she was bothered by an unnatural somnolence, and has even gone to sleep standing up. Her hair has fallen out a great deal, and it has entirely disappeared in the axillæ. The skin is dry and rough, and the feet seem to do the sweating for most of the body. She is always cold. She often has pain in the left axilla.

The patient is a short, heavy woman, with a peculiar olive tint, which she says has been deepening since the menopause. Her hair is well streaked with gray. The face is slightly paretic on the right side. Eye movements are normal and the pupillary reflexes are intact. There is no icterus of the scleræ, and the lids are not œdematous. The tongue is extruded markedly to the left, and can be brought to the median line only with effort. The thyroid is very small. There are typical pads over the clavicles, and the left one is painful. There is a ring of fatty tissue about the lower ribs. The lungs and heart are apparently normal; the pulse is regular, full, and strong, 80 to the minute. The arterial walls are good. The liver is slightly enlarged. The fingers are well shaped. Many of the joints crack loudly when moved. There is slight œdema of the legs. The plantar arches are weakened, and flatten out under her weight. The deep reflexes are slightly exaggerated, but the skin reflexes cannot be elicited. The musculature is good.

There is 85 per cent. of hemoglobin; the leukocytes are normal in number; polynuclears, 47 per cent.; the lymphocytes, 33 per cent.; the large mononuclears, 18 per cent.; and eosinophiles, 2

⁹ Jour. Amer. Med. Assoc., 1907, xlviii, 1404.

per cent. There are many microcytes and macrocytes, but no normoblasts.

The arches were immediately supported, better shoes secured, and the pains in the legs lessened. Six grains of thyroid a day soon caused marked thyroidism, and the dosage had to be reduced by half. The flat feet probably caused the pains in the legs and back, but the giving way of the arches was undoubtedly due to hypothyroidea and general asthenia. The disease here appears in a nullipara; there is a typical myxœdematous ring about the lower ribs; the hair has disappeared from the axillæ, and the skin reflexes cannot be elicited.

Cushing¹⁰ says that if we will watch more carefully we may often identify symptoms of hyposecretion of the hypophysis due to its indirect involvement in cerebral neoplasms. Thus we may account for the marked increase in weight, the amenorrhœa, and somnolence not infrequently seen with these disorders. This may be the explanation of the unusual symptoms in the case just described. This woman has had a marked increase of weight; there has been complete amenorrhœa for several years; the sexual organs have been seriously affected, as she has never conceived, and undoubtedly has had many opportunities to do so. Somnolence has been observed in many cases of myxœdema, and is associated with the mental hebetude, but it is rarely complained of in hypothyroidea. The paresis of the tongue and face points to some old trouble at the base of the brain. Several cases of myxœdema have been reported in which a nasal optic atrophy and other findings suggested hypertrophy of the hypophysis.

The next case is not typical of hypothyroidism, but is one in which the wonderful improvement seemed to prove that the exaggerated symptoms of the menopause were due to insufficient thyroid secretion. It is all the stranger when we consider that hot flushes, rapid pulses, sweating, and insomnia are symptoms rather of hyperthyroidism. This case showed the great danger of the patent antifat remedies which contain thyroid. This woman was in a critical condition after taking four grains a day for five days. Since then I give only enough capsules for two or three days, so that the patient has to return for observation. It would seem that persons with hypothyroidism are especially sensitive to thyroid extract, as experiments on normal subjects have shown but slight disturbance even after enormous doses.

CASE III.—C. F., French; a cook; widow; aged forty years; complains of "rheumatism," dyspnœa on exertion, and great mental depression. She has always been healthy and a hard worker up to the last year. She has one daughter aged eighteen. Men-

¹⁰ Jour Amer. Med. Assoc., 1909, liii, 249.

stration was normal up to six months ago, when it suddenly stopped. She began to get gray at an early age.

Three years ago her legs began to swell, especially in the afternoons, and for the last year she has been unable to work on account of asthenia and dyspnoea on exertion. She has rheumatoid pains in the larger joints, especially those of the lower extremity; there is persistent backache and the characteristic giving way of the knees. Since the sudden stoppage of the menses she has had hot flushes and perspires excessively. She has become very sad and morbid, with strong suicidal tendencies. There is obstinate insomnia, and the sleep obtained is not restful. Her memory has become very poor, and she has had hallucinations of hearing.

The patient is a short, stout, intelligent woman, with a sad, tired face. The thyroid gland is very small. The supraclavicular fossæ are well filled with fat, but there are not the characteristic pads. The lungs are clear and the heart apparently normal. The pulse is regular and 90 per minute. There is a relaxed vaginal outlet, with slight retroversion of the uterus, and a large cervix with an erosion and considerable discharge. There are varicose veins on both legs, with slight œdema. The plantar arches are in good condition. Urine analysis shows no albumin, sugar, or casts. The blood is practically normal except for 85 per cent. of hemoglobin and slight poikilocytosis.

The pelvic organs were restored to a healthy condition, the varicose veins were supported, the hemoglobin was brought up to normal, and satisfactory sleep was secured, and still the patient was in practically the same condition, unable to do any work on account of the pains and weakness, and suffering from a mild melancholia. On account of the few symptoms of hypothyroidism, she was given two capsules of thyroid a day. She returned in five days with her clothes hanging about her. She had lost nearly twenty pounds and was very nervous, with a pulse of 120 per minute. Thyroid was immediately stopped, and she gained a few pounds. Her whole disposition seemed to change; she forgot her fears and troubles, and as her strength returned she went to work with her old energy. During the next two months she occasionally needed a little thyroid, but, like most of these cases, she reacted very quickly, and the dosage had to be small and carefully watched.

Some of the severer and older cases do not react well to the treatment, probably because permanent changes have been wrought throughout the body. For the same reason, thyroid seldom has any effect on older cretins. Modern surgery may soon come to the aid of these hopeless cases. Payr achieved an excellent result by transplanting a large piece of the mother's thyroid into the spleen of a myxœdematous child, who had derived no benefit from two years of thyroid feeding. Lately, under Kocher's direction, pieces

of thyroid have been successfully transplanted into the epiphyseal junctions of the long bones of animals, and have there taken up their function. Salzer has been repeatedly successful in transplanting thyroid tissue into the abdominal wall of rabbits.¹¹ Carrel has recently discussed the problems involved in these transplantations.¹²

Symptoms of thyroidism are probably met with much more frequently than those we have just been studying, and the interpretation is still more difficult. A true case of Graves' disease, with marked exophthalmos, tachycardia, tremor, and asthenia, is easy enough to diagnosticate, but when a girl is overemotional, with a rapid pulse, sweats, occasional diarrhoea, and sometimes a little fever in the afternoons, one is more likely to think of hysteria, incipient tuberculosis, or anemia. And even if we recognize the symptoms as those of thyroid overaction, the important questions remain: What is the cause? Is it a transient affair due to some intoxication, or are there changes in the gland which will progress until they induce true exophthalmic goitre? We have yet to obtain a sufficient number of life histories of such cases to prognosticate the dangers of these mild toxæmias. When an attack of scarlatina leaves a girl with scarred and damaged kidneys, we are fearful for the outcome of a pregnancy or an attack of pneumonia. By analogy, the weak spot in these persons would be the thyroid gland, and any extra strain such as shock or infection would be more liable to bring on Graves' disease or other disasters.

Fortunately, we need have no such fears for most cases of hypothyroidea, as it does not tend to go on to the complete form, and spontaneous recovery is probably very common. Another point to be noted is that the thyroid given probably stimulates the gland to take up its work again, otherwise medication would have to be continued indefinitely as in operative myxœdema.

A. R. Elliot¹³ mentions as a cause of thyroidism the venous engorgement of the thyroid in heart affections, particularly lesions of the mitral valve. In advanced cases, it may be difficult to tell which is the primary lesion. He describes a toxic form seen in the anemias, digestive toxemia, syphilis, diabetes, and Bright's disease. If it be proved that chronic nephritis can be the cause of thyroidism, we may have another explanation of the exophthalmos seen in that disease. Dr. Barker has observed this symptom in 16 out of 33 cases studied in the Johns Hopkins Hospital.

The following history portrays a case in which a mild thyroidism, following a mental shock at the age of twelve, probably predisposed the patient to a thyroid instability, which was brought out in later years by syphilis.

¹¹ Arch. f. klin. Chir., lxxxix, 1909.

¹² Loc. cit.

¹³ Surg., Gynec., and Obstet., 1909, viii, 606.

CASE IV.—G. de V., Mexican; married; aged thirty years; complains of general weakness and nervousness. She was perfectly well up to the age of twelve, when she became inconsolable over the sudden death of both parents. She then suffered from substernal oppression, extreme nervousness, tremor, and hot flushes, and for awhile her friends noticed a staring expression of the eyes. These symptoms disappeared of themselves, and though a tendency to weep at any provocation remained, she has enjoyed fair health until three years ago, when she married a man with late secondaries. She has never conceived, and so far as can be ascertained has had no symptoms of syphilis besides mucous patches. For the last year she has been a nervous wreck, spending most of her time helplessly in bed. She has grown very thin; her appetite is *nil*, and constipation is extreme. She sweats excessively, especially from the hands, but generally keeps wrapped up closely on account of a sensitiveness to cold. She sleeps very little, and then frequently awakes with spasm of the larynx and a fear of choking to death.

The examination revealed a small, thin, nervous, intelligent woman, wrapped up in bed and perspiring profusely. She has considerable gray hair, and has had some for several years. There was no exophthalmos; the lungs were clear; the heart not enlarged, and the sounds normal. Pulse, 50 per minute and regular; blood pressure, 160 mm. of mercury. The pelvic organs were apparently normal. The thyroid was enlarged, the right lobe reaching as far as the clavicle, and overlaid with markedly pulsating bloodvessels in its upper part. The left lobe was the size of a large hazel nut. There was 85 per cent. of hemoglobin. Otherwise the blood was normal. The urine contained no albumin.

She was taken from her bed, given psychic and general tonic treatment, and was soon taking regular exercise and getting stronger. Then extrasystoles appeared, and for the next few weeks she exhibited every form of regularly irregular heart, and would change suddenly from one form to another and back to normal again for awhile. Her strength continued to improve, but she became very nervous and frightened over the pauses after the extrasystoles and the slowness of the pulse, which would drop to forty per minute at the wrist. The only thing that gave any relief was sodium nitrite, which lowered the high blood pressure, but a severe cold left her worse than before. About that time the husband confessed that he had had active lesions at the time of his marriage, and was still in need of aggressive treatment. They were both put under treatment, and the wife steadily regained her health, so that now she does her own housework. The pulse became normal in rate and rhythm, and the thyroid decreased in size. She is still greatly affected by colds, which upset her entirely and cause a recurrence of the nervousness, tremor, and irregular heart.

The next case is one of those in which symptoms of hyper-

thyroidism occur in a woman with an old, previously innocuous goitre.

CASE V.—L. K., Mexican; widow; aged thirty-five years; complains of difficulty in speaking and swallowing, and a burning in her throat. Menstruation began at the age of fifteen, and was regular, scanty, and always painful. Married at nineteen, she has had three children, who all died in infancy. There were no abortions. A goitre appeared coincident with the first pregnancy, and grew fast enough to be very noticeable at the birth of the child. There was tremor, weakness, and nervousness, but no exophthalmos.

After a long period of quiescence, the tumor is slowly growing again, so as to affect her voice and swallowing. It also causes a dry hacking cough. She is very nervous and depressed, and cannot sleep. She has grown thinner and weaker, and her knees give way from under her. She menstruates slightly for a day or two, and often misses periods. There is persistent pain in the left hypochondrium. She feels cold all the time; never sweats, and the skin is so dry that her stockings are full of scales. She has annoying hallucinations of hearing, and sometimes tinnitus. She cannot look upward without a drawing sensation, and the lids feel as if held shut. Constipation is extreme. There is very little dyspnoea on exertion, and the heart's reserve force seems to be good. There is occasionally slight swelling of the feet.

The patient is a tall, thin, sad-looking woman, whose intelligence seems to be considerably impaired. Slight exophthalmos gives a staring expression to the eyes. There is no tremor. The voice is harsh, and she speaks as if the mouth were full of food. There is a large rubbery goitre. The heart is slightly enlarged, and there is a loud systolic murmur best heard at the apex, but also all over the precordium. The second pulmonic sound is accentuated. The pulse ranges from 100 to 120 per minute, is of small volume, and generally regular in force and rhythm.

The treatment was entirely unsatisfactory, as she did not react to anything. Even six drams of sodium phosphate a day had no effect on the constipation. Sedatives and rest produced no effect on the nervousness, and nothing relieved the burning in the throat. Thyroid was tried without any result.

In this and the preceding case, hyperthyroidism was predominant, but at the same time there were several symptoms that usually occur with incomplete myxoedema. In the first case, there was slow pulse, with high blood pressure, irregular, however, and susceptible even to changes in position; chilliness; spasms of the larynx and premature grayness; in the second, pain under the left breast, coldness, dry skin, hallucinations, and tinnitus.

It has long been known that a case of exophthalmic goitre can progress through a mixed indefinite type even to typical myxoedema. These stages correspond to advancing pathological

changes in the thyroid gland. At first there is simple hyperemia and slight change in the colloid; then there is cellular hyperplasia and increase of the colloid. The cellular hyperplasia goes on, there are imperfect alveoli lined with large cells, and the colloid nearly disappears. In the last stage there is fibrosis, atrophy of the cells, hemorrhages, and cysts.

Rogers and Beebe¹⁴ emphasize the complexity of the treatment in the indefinite cases, and report several instances in which improvement was obtained only by simultaneous administration of small doses of thyroid protein and their specific serum. They advocate the use of the purified thyroid protein in very small doses, $\frac{1}{80}$ grain or less, and they believe that it will give results when the desiccated thyroid will not. The latter may be given in $\frac{1}{4}$ grain doses, and even then carefully watched. They enumerate the following types that may require combined treatment:

1. Patients who develop thyroidism late in life: (a) Those who, after middle life, show thyroidism for a varying period before the appearance of a goitre. (b) Those who have borne an innocuous goiter for years, and late in life develop signs of thyroidism.

2. Atypical forms of thyroidism: (a) Generally women of any age who present many signs of thyroidism, but who often have a dry skin and bradycardia, and are usually considered neurotic and neurasthenic. (b) Patients with nervous and vasomotor signs of thyroidism, but who complain of a more or less constant headache, accompanied in most cases by nausea and abdominal discomfort. (c) The psychopathic cases.

It is to be hoped that their serum will be perfected and made easily procurable, as the mild cases of thyroidism are quite common and react very poorly to the usual sedative treatment. These are the cases in which they obtained the largest percentage of complete success, with the most prompt and striking results, probably because there are no complications and no lasting changes in the gland. Ordinarily these patients are given rest and tonic treatment and recover only to relapse on getting up. Sometimes they seem to do better with moderate exercise in the open air, but they will only be relieved, and any little cold or indigestion will cause them to lose all they have gained.

Juvenile Myxædema. When confronted with a fat stupid-looking child, stunted in mind and body, one has to think of several conditions, such as Mongolian idiocy; chondrodystrophy, which produces the typical dwarf; dystrophia adiposogenitalis of Fröhlich,¹⁵ caused by tumor of the hypophysis; cretinism; and juvenile myxoedema. The last named disorder causes a late cretinism, and seems to bear the same relationship to cretinism that hypothyroidism does to complete myxædema.

¹⁴ Arch. Int. Med., 1908, ii, 297.

¹⁵ Wien. klin. Rundsch., 1901, 47, 48.

It is seen more frequently in boys than in girls, and often follows an attack of measles. The development is retarded, and there is a tendency to obesity and a protuberant abdomen. As a rule, the intelligence is but slightly impaired. Walking, talking, and dentition are apt to be delayed, and the teeth may be erupted carious. Adenoids are frequent and help to keep the thickened lips separated, while the swollen tongue protrudes and gives a characteristic look to the face. The following case would probably fall under this classification.

CASE VI.—C. C., a Mexican boy, aged seven years, is brought by his parents to ascertain the cause of his inability to speak above a whisper. The histories of both families are good. The father and his brothers all speak thickly. There were fifteen children, of whom thirteen are living, and all are healthy but two—this one, and another who had convulsions when eight days old and has grown up hydrocephalic and mute. Infectious diseases caused the two deaths. This child has always been healthy except for an attack of varicella. He walked at fourteen months, and did not begin to talk until two years old. His intelligence has been about the average. He has always been very morose and unapproachable, and does not form friendships with other children. They torment him with the nickname "Japones," on account of his resemblance to a Japanese child. In December, 1907, he had a slight attack of measles, from which he made an uneventful recovery. Five days later he was a little hoarse, and since then has not spoken above a whisper.

The boy is a little small for his age; his bones are well shaped and sized; he is a little too fat, and the abdomen is protuberant; the skull is well shaped, and the fontanelles are closed. The palpebral fissures are not oblique, and the Mongolian expression is produced by the large tongue protruding between his lips and the general facies of cretinism. He is very surly, and speaks only in whispers. There are a few small adenoids. The nose is quite normal. Hearing is slightly impaired. The vocal cords appear to be normal in every respect, and there is no paralysis. No thyroid can be felt. The hands are pudgy, with short fingers. The teeth show a most remarkable condition in that there is almost no enamel to be seen on any of them. His hair is coarse and straight.

A grain and a half of thyroid a day was given, and the boy has slowly recovered his speech and become more like a normal child.

One of the most confusing things in the study of these disorders, and one that has caused much difference of opinion, is the intimate relation of all the ductless glands one to another. Hence one must always keep in mind that the symptoms observed after the extirpation of one of these organs may be due not only to the loss of that organ, but to changes, compensatory or otherwise, in the remaining glands and their internal secretions. For the clinician also, difficulties are placed in the way of assigning certain symptoms to the complex of one particular gland.

Falta lays particular emphasis on this intimate relation, and compares a pathological process in one of these organs, and its effects on the others, to the associated changes observed in derangements of a part of the hematopoietic system. In his Oration on Surgery at the last meeting of the American Medical Association, Cushing¹⁶ said: "It is impossible to remove—probably partially to remove—the hypophysis without producing marked alterations in all the other glands—thyroid, parathyroid, adrenal, testicle, ovaries, islands of Langerhans, and thymus."

Changes in the hypophysis after castration or thyroidectomy are well known, and now the reverse has been found true—there is acute hypertrophy of the thyroid after hypophysectomy, and sexual power is lost in all affections of the hypophysis. A careful study of 122 cases recently reported by Erdheim and Stumme goes to prove that the hypophysis increases in size and weight with each pregnancy, and at last remains enlarged. They think that this may account for the swollen face, lips, and hands sometimes seen in the later months of pregnancy. The symptoms of hypopituitarism may closely resemble those of hypothyroidea—adiposity, polyuria, shedding of hair, and lessening of sexual activity. Castration will produce adiposity, and the symptoms of the menopause may be those of thyroidism. Injury to or loss of the parathyroids produces some of the symptoms that were formerly considered of thyroid origin, and we may yet distinguish and separate some more. The spasms of the larynx, the rheumatoid pains, and the loud cracking of the joints sometimes present in hypothyroidea have all been observed in hypoparathyreosis. On account of the close relation of the parathyroids to the thyroid, they could easily be affected by pressure or by the same pathological process that affects the larger gland. There is also a chemical relation that may be affected, as it has been shown that in thyroidectomized dogs, the effects of adrenalin are much diminished, but if the parathyroids are also removed, the action is increased.

Excepting confinements, probably 95 per cent. of the night calls in this part of Mexico are for "ataques." The subject is almost always a woman, generally young and frequently a sufferer from the mild forms of thyroidism. They may be convulsions, twitching, chattering of the teeth, and substernal pain and oppression, but the most characteristic symptom is the numbness that may travel from one extremity to another, or remain in an arm, or leg, or one half of the body. At first sight, these attacks would be put down to hysteria, but when the sober mother of a family awakes suddenly at night with an "ataque," one feels the need of an etiology more definite than the word hysteria. Anyone seeing a case like that re-

¹⁶ Loc. cit.

ported by Halsted,¹⁷ without the history of a recent complete thyroidectomy, would probably call it hysteria. The resemblance of those "spells" to many seen here is very striking. In this connection, it may be worth while to relate the following case.

CASE VII.—The patient was a stout Mexican woman, aged twenty-four years, who had always enjoyed good health and whose menstrual life had been normal. Her illness began a week after her wedding, when she flowed profusely for three weeks. Some symptoms of thyroidism developed—tachycardia, tremor, enlarged thyroid and sweats, and occasional attacks of vomiting. She had several attacks with numbness, twitching, and fear of impending death, and she spent three weeks of every month in bed, on account of the excessive flow and nervousness. In spite of the hemorrhages and thyroidism, she gained in weight, and the lowest point reached by the hemoglobin was 65 per cent. She was treated by several physicians, and nothing had the slightest effect upon her condition. The pelvic organs were apparently normal, and curettement was refused. One day, in taking a blood smear, it was noticed that the blood clotted very slowly, and calcium chloride (the only salt then obtainable) was given as an experiment. The effect was marvellous. The flow stopped in a few days, and in a month she was a strong, capable woman, with complete control over her nerves and a normal pulse. Treatment was continued over another menstrual period, which was normal. She had remained perfectly well for over a year, but has never conceived. She is still very stout. Calcium was given here as an experiment with the hope of a temporary relief only, but it seemed to be the cause of the marvellous change in the patient's condition. Possibly an overexcitation of the ovaries caused them to functionate to excess and to implicate the thyroid, and directly or indirectly the parathyroids. The calcium administered may have affected the glands in the reverse order and established a balance.

Since studying the case just described, I have been trying to elicit the Chvostek and Trousseau signs just after patients have calmed down from an "ataque," and find that twitching of the lower part of the face can be induced by a modification of the Chvostek sign. The region just in front of the tragus is firmly rolled under the finger instead of striking, which would often be considered an indignity by the ignorant relatives. Of course this sign reveals simply the hyperexcitability of the muscles and nerves.

It may be some time before we get active extracts from every one of the ductless glands, but we may learn how to use their correlation to advantage so that we can treat the individual gland by restoring the balance of the system.

¹⁷ AMER. JOUR. MED. SCI., 1907, cxxxiv, 1.

TYPHOID SPERMATOCYSTITIS AND PROSTATITIS, AND THEIR RELATION TO CHRONIC TYPHOID BACILLURIA.

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INDIVIDUALS who have passed through an attack of typhoid fever may carry in their gall-bladder, urinary channels, or intestinal tract living virulent typhoid bacilli for an indefinite period of time. These people are termed "chronic bacilli carriers," and it is by excretion of the bacilli from these cases that typhoid fever is largely spread. It is not necessary that extensive pathological changes should be present in their organs; but, on the contrary, the slightest catarrh or the smallest amount of infiltration of the respective mucous membrane lining these organs often exists. It has been shown by Petruschky¹ that the urine is the great spreader of typhoid bacilli, and is probably more dangerous than the feces. Typhoid bacilli are often present in the urine in enormous numbers, and may remain for months or years without causing any symptoms. As a rule, they are the sole microorganism present. Apparently healthy people may have typhoid bacilli present in the urinary bladder and excrete them in the urine for a long period of time.

There have been cases in which the bacilluria was of extremely long duration, such as a case described by Liebetrau,² in which after nine years the bacilli were found in the urine, and a case reported by Houston,³ in which the bacilli were isolated after three years. Gwyn⁴ relates a case of typhoid fever treated in the hospital and discharged; the patient entered the hospital five years later with cloudy urine, the examination of which showed numerous typhoid bacilli. There are many other cases on record in which individuals have gone about the country a menace to the whole community.

It is generally supposed that, during the course of an attack of typhoid fever, typhoid bacilli circulating in the blood are excreted by the kidneys, and that the bladder urine serves as a culture medium in which they multiply rapidly. However, a simple or physiological excretion of microorganisms by the healthy kidney, with their appearance in the urine, has been shown by experiments in animals by Wyssokowitsch⁵ not to occur; the kidneys always show focal lesions. The studies of Konjajeff⁶ on human subjects is in accord

¹ *Centralbl. f. Bakt.*, 1898, xxiii, 577.

² *Arbeit a. d. Kaiser Gesundheitsamte*, 1906, xxiv, 341.

³ *Brit. Med. Jour.*, 1899, i, 79.

⁴ *Johns Hopkins Hosp. Bull.*, 1899, x, 109.

⁵ *Ztschr. f. Hygiene*, 1886, i, 3.

⁶ *Ref. Cent. f. Bakt.*, 1889, vi, 672.

with the animal experiments of Wyssokowitsch. He found at autopsy in typhoid fever cases small focal lesions in the cortex of the kidney, which he proved began by the lodgement of minute emboli in the smallest bloodvessels. These emboli were composed of bacilli and produced a necrosis of a circumscribed area of kidney tissue. The foci often communicate with the kidney tubules and lead to bacteria passing into the urine. The sudden appearance of typhoid bacilli in the urine late in the disease as in convalescence is especially of interest, and speaks for the late breaking into the urinary channels of the kidney lesion.

There have been a few instances in which the urine has become infected with typhoid bacilli in other ways. The possibility of infection taking place from without the urethra in the same manner as with *Bacillus coli*, or the streptococcus, has been suggested in Houston's case. Brown⁷ reports a case which was infected by the passage of a catheter. Blumer⁸ has suggested that typhoid bacilli may pass through the posterior vesical wall from the intestinal tract in the same way as Lesieur⁹ has shown that bacilli may enter the wall of the intestine, sometimes without producing a definite lesion. Jacobi,¹⁰ who observed four cases of long-drawn-out bacilluria, concluded that a nephritis was present and was often complicated with a hemorrhagic nephritis; and, moreover, his cases helped to prove that typhoid bacilli are only excreted by a diseased kidney. There were cases, however, reported by this author in which no albumin was present in the urine although typhoid bacilli were found.

These cases have received special study, and many observers have advised giving typhoid-fever convalescents some bactericidal drug, which in general causes the bacilli when present in the urine to disappear. But there are cases in which typhoid bacilli disappear from the urine when such drugs are given, and reappear at the end of a few weeks when treatment is stopped. The reasons for this condition have not always been clear. The bacilli in the case of Richardson¹¹ disappeared three times, and reappeared each time after treatment. Horton Smith,¹² Connell,¹³ and others have called attention to the recurrence of bacilluria after treatment in this manner; in these cases an ulcerative cystitis has been present, furnishing the source of urinary infection.

At the suggestion of Professor Ludwig Pick I have made a study of two cases of typhoid fever which presented anatomical findings of extreme interest when considered in relation to urinary infection. The first case showed an acute typhoid spermatocystitis, and the

⁷ Edin. Med. Jour., 1905, xix, 116.

⁸ Johns Hopkins Hosp. Rep., 1895, v, 327.

⁹ Hygiene gén. et appliq., Paris, 1906, i, 536.

¹⁰ Deut. Arch. f. klin. Med., 1902, lxxii, 442.

¹¹ Jour. Exper. Med., January, 1899.

¹² Lancet, 1900, p. 915.

¹³ AMER. JOUR. MED. SCI., May, 1909.

second case an acute typhoid prostatitis. Both of the subjects entered the hospital with the diagnosis of typhoid fever and went to autopsy. I am indebted to Prof. Dr. Stadelmann, director of the hospital, for the histories of the cases.

CASE I.—The patient was a man aged seventeen years, who entered the hospital with the diagnosis of typhoid fever. On account of his comatose condition an exact history could not be obtained. It was learned from the mother that he had been in poor health for a week, and had some headache and cough. The family history was negative. The mother believed the present illness to be of about fourteen days' duration. The patient was in the hospital for nine days in a semicomatose condition with severe typhoid symptoms, and finally died from perforation.

The autopsy made by Professor Pick showed: Typhoid ulceration in the ileum with perforation, fibrinopurulent peritonitis, cystitis with small hemorrhage in the urinary bladder, purulent spermato-cystitis and right deferenitis, ulcer on the epiglottis, parenchymatous nephritis with miliary abscess, obliterative pleuritis and diffuse bronchitis, and aspiration of stomach contents.

The detailed findings in the seminal vesicles, were as follows: The seminal vesicles are somewhat enlarged, the right more than the left; both fluctuate. On the outer surface they are reddened. The left seminal vesicle is filled with a more grayish fluid. The vas deferens contains likewise some thick yellowish fluid. On the right side the vas is normal. By pressure from behind on the penis no secretion can be pressed out. The urethra is smooth and pale. The prostrate gland shows no changes.

From the purulent material taken from the seminal vesicles plates were made by Professor Pick upon agar and Conradi-Drigalski media, from which were obtained numerous colonies of a living motile bacillus with the following cultural characteristics: Litmus milk was not coagulated, neutral red was not reduced, no gas was formed, the growth upon potato was not visible, and upon Conradi-Drigalski media blue colonies were formed. Controls were made with typhoid and colon bacilli upon the above culture media, and typical growths were shown. From the growth upon culture media it was seen that we had to do with an organism that has the same cultural characteristics as the typhoid bacillus. The agglutination tests were carried out with the following results: In a dilution of 1 to 10, 1 to 100, and 1 to 1000, the bacilli were killed and clumped completely within ten minutes. In a serum dilution of 1 to 2000 and 1 to 5000 the organisms were clumped within ten minutes. Controls were made and were negative, including the reactions with a known culture of paratyphoid α . Injection of the culture into guinea-pigs showed a lessened virulence. The behavior in animal experiment was the same as is produced when cultures of typhoid bacilli are injected.

The histological findings of this autopsy are of extreme interest in relation to the seminal vesicles. Section of the left seminal vesicle shows the mucosa in many places to be destroyed, and in others distorted and infiltrated. The lumina are dilated and filled with an acute cellular exudate which is partially necrotic. The exudate is composed of many polymorphonuclear leukocytes, plasma cells, lymphoid cells, and, besides these, are found desquamated epithelial cells from the lining of the gland. There are present round cells in the submucosa in irregular heaps infiltrating the connective tissue.

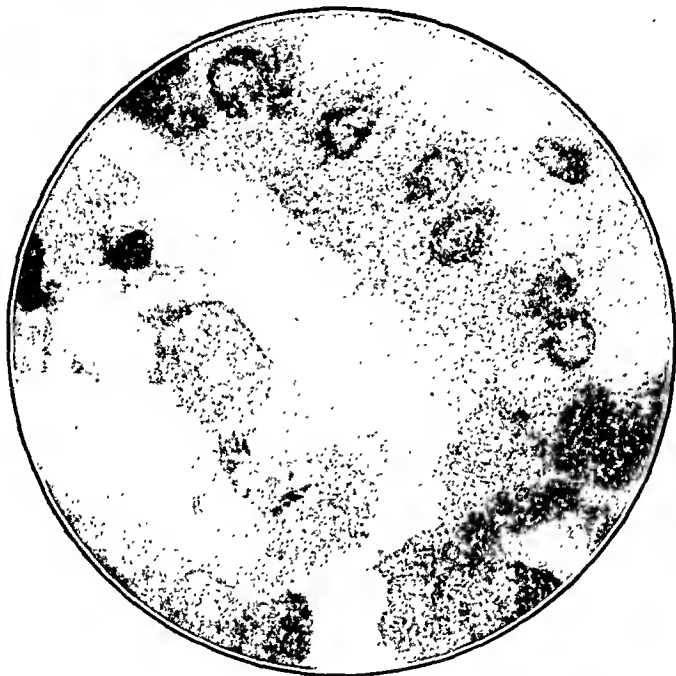


FIG. 1.—Section of seminal vesicles from Case I, stained with carbol-fuchsin, showing breaking down of epithelial cells, in which clumps of typhoid bacilli are seen in the lumen of the gland. (1/12 oil immersion, ocular No. 8.)

When these sections were stained with carbol-fuchsin and decolorized with alcohol, by careful search, rod-shaped bacilli were found lying in the lumina of the glandules (Fig. 1.) Sections stained by Gram show that these microorganisms are negative to that stain. In their morphological and staining characteristics these bacilli are identical with typhoid bacilli.

CASE II.—A male, aged twenty-eight years, was admitted to the hospital with a diagnosis of typhoid fever of about ten days' duration. Death took place from hemorrhage of the bowel four days after admission.

The autopsy by Professor Pick showed: Typhoid ulcerations in the ileum, universal icterus, subepicardial and subpleural hemorrhages, acute tumor of the spleen, parenchymatous nephritis with

small abscesses, acute purulent prostatitis, swelling of the mesenteric lymph glands, and acute catarrh of the duodenum.

The important feature of this case was the condition found in the prostate, which was as follows: The prostate gland is of rather large size, the right lobe being the larger. In the lobes is an area the size of a bean containing a purulent, yellow, granular material upon a reddened floor. By pressure upon the lobes, pus exudes. The testicles and epididymis are free from change. On the left side is a small hydrocele. The seminal vesicles are moderately filled and on the outer surface injected. The inner surface of the seminal vesicles is not injected.

In this case cultures were made by Professor Pick from the spleen, gall-bladder, lymphatic glands, and from the purulent material expressed from the prostate gland. From the spleen, lymph glands, and prostate, a living motile organism was isolated, which on Conradi-Drigalski media showed blue colonies, produced no gas and no indol; neutral red was not reduced, litmus milk was not changed, and milk was not coagulated. This organism, therefore, in its cultural characteristics was identical with the typhoid bacillus.

Further tests were carried out with the strain isolated from the prostate gland as follows: A guinea-pig, 275 grams in weight, was injected with 1 to 2 c.c. of a twenty-hour-old culture. The animal was not killed. Further animal experiments showed that in its behavior this culture is the same as cultures of the typhoid bacillus. Agglutination tests were carried out with typhoid agglutination serum. This organism isolated from the prostate gland was agglutinated by the following dilutions of this serum: With a serum dilution of 1 to 100, 1 to 1000, and 1 to 2000 the organism was killed and completely clumped in less than ten minutes. In a dilution of 1 to 5000, 1 to 10,000, and 1 to 20,000 the organisms were killed and clumped in fifteen minutes at 37° C. All controls necessary were made, including reactions with paratyphoid α , and gave negative results. Additional agglutination reactions were carried out with the organism isolated from the mesenteric lymph glands, and identical results were obtained as with the organism isolated from the prostate.

Histological examination of sections from the various organs from this autopsy were made. Of great moment were the findings in the prostate gland. Section of this shows an acute purulent exudate with breaking down of the glandular cells. In this exudate can be seen, when the sections are stained with carbol-fuchsin and decolorized with alcohol, bacilli lying singly and in small groups (Fig. 2). These organisms, which present the morphological characteristics of typhoid bacilli, are Gram-negative.

There is no doubt but in both of these cases were examples of genuine typhoid infection. The first case showed living, virulent typhoid bacilli in the seminal vesicles while the prostate gland was

free. The second case showed the typhoid bacilli in the prostate gland with normal seminal vesicles. The bacilli in both cases were in the lumina of the glands outside of the secreting cells.

The findings in these two cases at autopsy has led to the suggestion that the seminal vesicles and the prostate may be infected in patients who have typhoid fever. From the location of the typhoid bacilli in the stained sections, and because of the fact that some infections of the prostate gland and seminal vesicles have a tendency to assume a chronic character, there is reason to believe that in subjects recovering from typhoid fever, the prostate gland and the seminal vesicles may sometimes harbor typhoid bacilli for a long time.

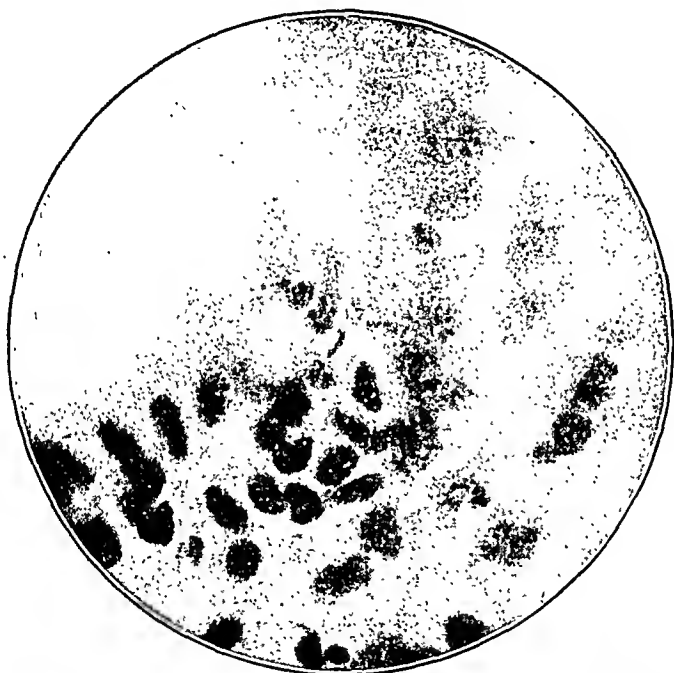


FIG. 2.—Section of prostate gland from Case II, stained with carbol-fuchsin, showing breaking down of the normal structure. Two rod-shaped organisms (typhoid bacilli) are seen in the centre of the section. (1/12 oil immersion, ocular No. 8).

It can easily be assumed that the bacilli may readily pass into the urethra with the semen as in the first case, and with the prostatic secretion in the second case, reach the urinary bladder, and produce a typhoid bacilluria. In this way we may explain the recurrence of typhoid bacilluria on the suspension of treatment, and also the fact that no clinical signs of kidney lesions are found in these patients. Clinically, therefore, in patients with typhoid bacilluria, the possibility of infection of the urine from these lesions in the prostate gland or seminal vesicles should be considered. In long-continued bacilluria, especially in patients in whom the microorganisms disappear under treatment and then reappear at a later

period, and also in "chronic bacilli carriers" in whom the excretion of typhoid bacilli is by way of the urine, the attention of the clinician should be directed to these organs as offering a source for the distribution of the typhoid bacillus.

In conclusion, I extend my heartiest thanks to Professor Ludwig Pick for the suggestion and opportunity of carrying out this work.

VON GRAEFE'S SIGN IN MYOTONIA CONGENITA (THOMSEN'S DISEASE).

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THE congenital familial myopathy which is characterized by stiffness or hypertonicity of the voluntary muscles upon attempted motion, peculiar electrical reactions, and a chronic course little affected by treatment, has, in most of its manifestations, been sufficiently discussed. Although this condition was described by Leyden¹ in 1866, the classical description by Thomsen² has been the basis of most of the subsequent study. The most valuable addition to this subject since Thomsen's is the careful work of Erb,³ with the announcement of the peculiar electrical reactions of the muscles of the myotonics.

The present study was undertaken because of the observation of a family with a history of marked von Graefe sign for five generations. The von Graefe sign is so evident that it is considered by the family the most interesting manifestation of the condition, and the underlying myotonia had gone undiagnosed through several generations.

Most of the descriptions of these cases do not mention the eyes at all. Many reports state definitely that the eyes were not affected.⁴ The pupillary reflexes are stated to be normal by several.⁵ Squint,⁶

¹ Deut. med. Woch., 1892.

² Arch. f. Psychiat., 1875-76, vi.

³ Deut. Arch. f. klin. Med., 1889, xlv.

⁴ Peters, Deut. mil.-ärztl. Ztschr., 1879, viii; Petrone, Riv. sper. di freniat, 1881, vii; Weichmann, Inaug. Diss., Breslau, 1883; Schönborn, Deut. Ztschr. f. Nervenhe., 1889, xv; Cook and Sweeten, Brit. Med. Jour., 1890; Bernhardt, Virchow's Arch. f. path. Anat., lxxv; Haynes, Jour. Nerv. and Ment. Dis., 1897; Pelizaeus, Centr. f. Nervenhe. u. Psychiat., 1897; Gessler, Med.-Cor.-Bl. Würt. ärztl. Ver., 1898, lxxviii; Mele, Gio. med. d. esercito, xlv. 1898; Hoffman, Festsehr. W. Erb, 1900; Brinckmann, Inaug. Diss., 1902; Braun, Inaug. Diss., 1902; Modena, Riv. sper. di freniat, 1905; Curschmann, Berl. klin. Woch., 1905.

⁵ Schönfeld, Berl. klin. Woch., 1883; Delogu, Gazz. d. osp., 1897, xviii; Rizzoti, Boll., d. clin. 1903; Carnecross, Jour. Nerv. and Ment. Dis., 1903; Seeligmüller, Deut. med. Woch., 1876.

⁶ White, Guy's Hosp. Rep., 1889; Wichmann, Neurol. Centr., 1897, xvi; Mearns, Arch. Pediat., 1905.

diplopia,⁷ inequality of the pupils,⁸ emmetropia,⁹ nystagmus,¹⁰ and a jerking motion upon following the finger,¹¹ are mentioned in various cases. Thomsen himself observed that the facial muscles are affected, and made special mention of the orbicularis palpebrarum. That the eyes are opened with difficulty is frequently stated.¹² Messaroch speaks of the eyes closing with difficulty. More or less humorous conditions are described by several observers: the eyes remain closed upon sneezing¹³ or after washing. Westphal and others¹⁴ mention involvement of the external eye muscles, and Bechterew¹⁵ cites a case in which the patient had to open his eyes with his fingers. Preston¹⁶ speaks of the eyes "setting." Hlavaczek and Jacoby¹⁷ refer to the "catching of the eyes."

After a careful search I have been able to find but one notation of the von Graefe sign, in connection with myotonia congenita, and that is by Oppenheim in his text book on nervous diseases; he states that he observed such a case, and says that the fact was confirmed by Mann. This was, however, a single case, and it is not stated that the sign occurred through several generations as the salient feature.

Buzzard¹⁸ says of one of his cases: "Occasionally his eyelids will become partly fixed in a half-open position, so that for an instant he can neither open them further nor shut them." In Preston's case: "When he looked fixedly at an object his eyes became set." "At times his eyes rolled up to such an extent that only the whites were visible." Meara describes one of his cases as follows: "The eyes show a convergent strabismus. The father says that before the glasses were prescribed (a year ago) he was accustomed to carry his head down with the eyes turned downward, and when he wished to look up he would lift his head, and then the whites of his eyes could be seen. The eye condition could readily be attributed to the stiffness of the ocular muscles." Messaroch's patient may have shown something similar to von Graefe's sign. He says: "When the eyes were opened exceptionally wide, it was not possible for him to close them at once, that is, in changing the direction of vision." Ballet reports an interesting involvement of the ocular muscles, but in an "acquired" case of myotonia.

The family whose chart of descent is here presented is of the oldest New England stock. Of the twenty-nine members recorded,

⁷ White, loc. cit.

⁸ Hoffman, Deut. Ztschr. f. Nervenhe., 1896. ix.

⁹ Mahler u. Beck, Wien. klin. Woch., 1900.

¹⁰ Raymond, Jour. de méd. interne, Paris, 1902; Pelz, Arch. f. Psychiat., 1906-07, xl.

¹¹ Eulenberg u. Melebert, Berl. klin. Woch., 1885; Angell, Jour. Nerv. and Ment. Dis., 1891; Raymond, loc. cit.

¹² Engel, Phila. Med. Times, 1882; Pontoppidan, Neurol. Centr., 1884; Friis, Neurol. Centr., 1892; Benoit, Arch. de méd. et pharm. mil., 1892, xx; Dejerine et Sottas, Rev. de méd., 1895.

¹³ Seifert, Arch. f. klin. Med., 1890; Ballet, Progrès méd., 1902; Hølemans, Arch. méd. belges, 1905; Messaroch, Allg. med. Centr. Ztg., 1904.

¹⁴ Berl. klin. Woch., 1883.

¹⁵ Deut. Ztschr. f. Nervenhe., 1905.

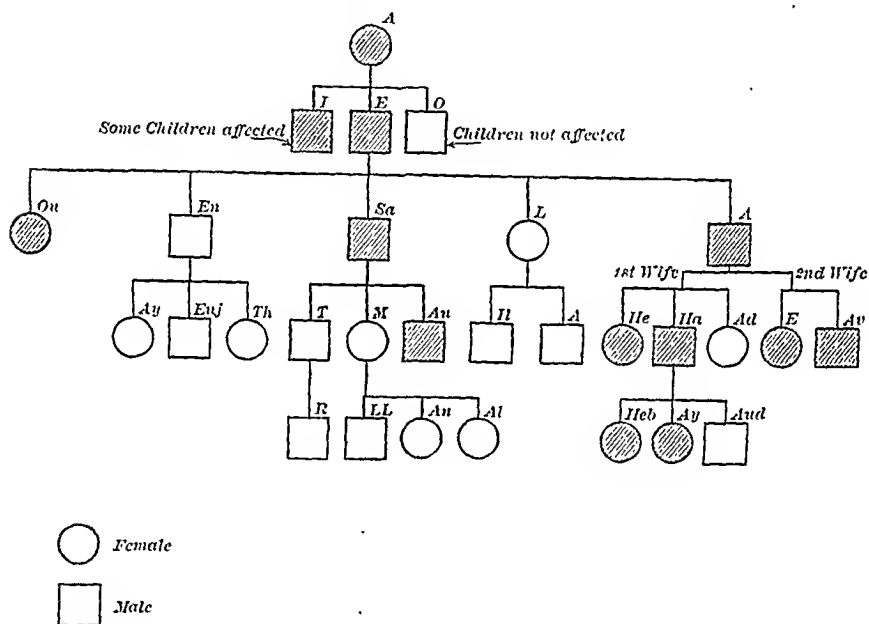
¹⁶ Med. News, 1898, lxxiii.

¹⁷ Jahrb. f. Psychiat., 1895.

¹⁸ Lancet, 1887.

thirteen were affected with myotonia and sixteen were free. All of those affected showed the von Graefe sign to a greater or less degree. Of the affected, seven are males and six are females, a fairly equal division. I have seen no members of the first and second generations among the fourteen of the family that I have observed, but the history of the von Graefe sign is very definitely related by Sa, of the third generation.

The patient Sa, of the third generation, was fifty-nine years old at the time of his examination, July 31, 1906. He was a civil engineer and the son of a New England sea captain who died of apoplexy at the age of forty-six years. His mother died at eighty, of some heart trouble. Two brothers and one sister were living, while one sister died at the age of sixty-one, of yellow fever.



The shaded portions of the diagram indicate those affected with myotonia and von Graefe's sign.

He stated that the following members of the family, who can be found upon the accompanying diagram, were affected with myotonia and manifested the von Graefe sign. In the first generation his paternal grandmother, in the second generation his father and his father's brother, were affected. In the third generation one brother and one sister were affected, while one other brother and one other sister were free. The myotonic brother transmitted it through two mothers to four out of five children. The unaffected brother and sister did not transmit it. None of them, he says, have complained of pain or disturbance of sensation. He had measles and pertussis as a child, and was in bed two days with influenza in 1892, without

complications or sequels. He has been otherwise exceptionally well, strong, and robust. His mentality is excellent.

The trouble with the muscles manifests itself as a "stiffness." There is especial difficulty in relaxing them when they are once "fixed." This is more marked in moist or cool weather, or when he is warm and cools off. He describes the condition as "cramp-like but not painful." He has marked von Graefe sign. He can "feel the upper lid hang back" when he looks down. He notices the condition in the tongue, eyelids, face, mouth, hands, and legs. Relaxation is more difficult than contraction. He has no trouble with the glottis, breathing, or sphincters. There has been little change in the condition since boyhood. If there is any difference, he is better now.

He tells of difficulty which he experienced in hurrying to morning classes at college. When he wished to mount a certain stairway, it was necessary to stop at the beginning of the climb. He would then take out a note book to cover up the real cause for the delay, gradually raise one foot and then the other until under way, when the movements went progressively better. His son attended the same college later, and often had difficulty on the same stairway.

The patient came under observation complaining of loss of appetite for the last eight or nine months, with occasional vomiting and "leg ache" for the last three months. During this time he has lost weight markedly. The myotonia had, however, existed during the whole life, and this condition, which will be referred to later, is a recent manifestation.

Examined on a bright clear day, the patient being under no form of excitement, the only muscles showing the trouble at the examination were of the eye. When the patient looked down, the upper lid did not follow the eyeball at once and a wide strip of sclera was left exposed. He said he feels the upper lid "hang back." Upon attempting to follow a finger downward, the eye went down in a jerky manner, and each jerk made the strip of sclera which was visible wider. The general muscular strength was much above that of the average man of fifty-nine years. The consistence of the muscles was normal. There was no fibrillary twitching.

December 1, 1906, he was examined again by Dr. Sheldon. He had lost twenty-two pounds. The nausea, vomiting, and loss of appetite had increased. Physical examination showed nothing further in explanation of the loss of weight and nutritional disturbance. He was well nourished and weighed one hundred eighty-four pounds. His musculature was good and the thorax of normal form. The heart and lungs were normal. The examination of the abdominal organs gave no findings of consequence. The urine was normal and the pulse full, regular, and of normal frequency. There was no goitre. The erythrocytes were 5,013,000 and the

leukocytes 5060 in number. The hemoglobin estimation showed 83 per cent.

An exploratory incision was made in another city in 1907. The gall-bladder was found to contain dark, thick bile, but there was no evidence of carcinoma. The anemia, anorexia, emesis, and loss of weight progressed until his death, in September, 1908, without a postmortem examination or a satisfactory explanation of the cause of the fatal issue.

It is of interest in this connection that some cases have been observed to develop into a form of muscular atrophy.

It will be noticed that this patient was a direct descendant of affected members, and that when once the line is broken by an unaffected member, the descendants of that one are free.

In the fourth generation I have observed M, T, and A unaffected; Au, Ha, and He affected.

Ha, of the fourth generation, is an army officer, aged thirty-three years on August 9, 1909. His mother died at the age of twenty-six years, and one sister died at twenty years in child birth. His father, who was a brother of Sa, had the "cramps" from boyhood, most markedly in the hands and eyes. His father had difficulty in getting up from a chair; that is, he could rise, but his legs would stiffen when erect, and the first step or two would be taken stiff-legged, after which the muscles would "limber up." He also had difficulty in deglutition, especially when he was excited or angry, at which times he would extend his head and protrude the lower jaw, making two or three attempts at swallowing to overcome the difficulty. In spite of the fact that the father has considerable trouble in opening his hands, he is still working actively at his profession of civil engineering.

As may be seen by the diagram, the patient's two sisters, one brother, and two daughters are myotonics. The patient had typhoid fever in 1898, but has otherwise been exceptionally well.

He cannot remember when he did not have trouble with the muscles. He recalls that when he was six or seven years old he tried to start in a race, when the muscles "set," and he fell sprawling. He was soon able to get up again and run. He found it difficult to let go of the ball when throwing.

Aside from the von Graefe sign, which he has to the most marked degree, he has difficulty in getting the eye opened when closed tightly, as in sneezing or shooting. Hot, damp weather, excitement, and rapid motion bring on the tonicity. Speech is not disturbed. To show the effect of excitement, he relates that once when examining prisoners in the Philippines, who were not telling the truth, he rose suddenly to threaten them, his muscles stiffened, he could not relax, and fell against the men. He fell to the floor, got up slowly, less excited, and soon relaxed.

He weighs one hundred and ninety-five pounds, is five feet ten inches

tall, and is a well-nourished, intelligent, active man. The examination of his heart, lungs, and abdominal viscera shows nothing abnormal. When he looks down the eyelids lag behind the balls for an appreciable time, and a wide band of the sclera is plainly shown. This is especially noticeable when he looks up first and then looks down quickly. The pupils react normally and the vision is good.

1. Mechanical stimulation, by tapping the arm, gives a slow, wave-like motion of the muscles.

2. Galvanic stimulation of the left first interosseous provokes a slow, wave-like contraction, the ACC being equal to the CCC.

3. The faradic reaction is good but slow, and is given by a much weaker current than in the normal control muscle.

Patient He, of the fourth generation, was observed in 1902 without the opportunity for physical examination. The von Graefe sign was present. She was an unmarried woman of twenty and a sister of Ha. Her own statement is as follows: "I first noticed the symptoms of this disease when eleven or younger. Sometimes, when running, the muscles above the knees would grow suddenly stiff and I would fall. I have noticed that the muscles of my eyelids are more apt to play me false in damp, cold weather, and sometimes when embarrassed, as when meeting strangers as a child. Getting warm and then cooling off rapidly will also cause the eyelids to seem to stick to the top of the eyeballs, while the balls themselves seem to protrude very far. This is not very painful, but very uncomfortable. When this occurs often, the eyes become a little inflamed and have a smarting sensation. They feel strained and tired also. I am either outgrowing it, or do not notice it so much. Other members of the family who are affected in the same way say they are not aware when the eyelids fail to come down over the ball. I always know, and by looking up until the muscles seem to relax, I can overcome it."

Patient Au, the son of Sa, and cousin of He and Ha, of the fourth generation, was twenty-five years old in 1905, and an engineer. His mother is living. One brother and one sister are not affected. The patient had tonsillitis and measles as a child, but has been otherwise well. He has noticed the "stiffness" of the muscles from childhood. It is especially noticeable in the upper and lower extremities and upon cold or damp days. Excitement brings it on. At times he is nearly free from it. He speaks of the difficulty of relaxing and releasing after shaking hands. This is especially noticeable upon shaking hands with another member of the family, when neither can let go.

I observed him after having had a slight operation on his nose, under cocaine. He arose from the chair, thus bringing his feet into plantar flexion. They remained in this position, and it was necessary for him to walk on his toes for several steps. At this same time the

myotonia of his hands was especially marked. The von Graefe sign, though present, is not so salient as in other members of the family. His mother, however, states that she noticed it first when he was an infant. On examination he was a thin, dark, active, intelligent young man. The examination of the chest, abdomen, skin, and lymphatics was without especial findings. Myotonia of the upper and lower extremities was marked while under examination. The von Graefe sign was not then present. Mechanical stimulation of the muscles by tapping, gave a markedly slow reaction. In addition, I have observed T, M, and A, of the fourth generation, none of whom show any myotonia. Ar and Heb, of the fifth generation, daughters of Ha, both show the von Graefe sign. Heb was three years old in November, 1909. She was a breast-fed child, and has been well except for frequent attacks of rhinitis. She is well nourished, and, with the exception of adenoids, gives no general physical findings of interest. It was possible to demonstrate a contraction of the interossei with 1.5 milliamperes, and no difference could be made out between the AC and the CC contractions. Faradic stimulation gave a marked reaction.

Ar was six years old on November 17, 1909. She was a breast-fed child, and with the exception of diarrhoea at the age of three months, and tonsillitis last winter, has had no acute affections. Her mother noticed the von Graefe sign when she was six weeks old. No other manifestation of the myotonia has been noted by the family. She is a well-nourished child, with no evidence of myotonia in her voluntary motions except the von Graefe sign. This is, however, not so marked as with her father, Ha. The pupils react normally to light and accommodation. The cervical lymphatics are palpable and the tonsils enlarged. The examination of the chest and abdomen shows nothing abnormal. The patellar, Achilles, and cubital reflexes are present. Faradic stimulation of the muscles gives a reaction with a much weaker current than is the case with her non-myotonic brother. The contraction is slow and lasting. Galvanic stimulation of the interossei gives a reaction with 2 milliamperes, and the ACC equals the CCC.

That so well-known a sign should be the salient feature of this familial condition is evidently rare. If we except the single case of Oppenheim, in which there is no record that the von Graefe sign is characteristic of the myotonics of a whole family, it is probably unique.

TORSION OF THE GREAT OMENTUM.

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It is only in recent years that the great omentum has come into much prominence in surgery and medicine. What its functions are is difficult for us to realize, since they are so numerous. The great omentum begins to develop in the third month. It starts at the greater curvature of the stomach and, extending gradually downward, passes over, first, the transverse colon and the small intestines. As it comes in contact in the first part of its course with the transverse mesocolon, the great omentum fuses with this and with the transverse colon, and their relations become permanent. The great omentum, or mesogastrium, in its development upward, becomes adherent to the ventral surface of the left kidney, so that it is adherent to the parietal peritoneum of the left kidney. Perhaps a small part of the omentum, in its development downward, becomes adherent to the parietal peritoneum of the right kidney, since the mesocolon, becoming adherent to the primary parietal peritoneum of the right kidney, leaves a surface with which the great omentum could easily fuse, just as its dorsal layer fuses with the transverse mesocolon. Or this condition of adhesions of the great omentum to the right kidney may be due to the fact that the ascending mesocolon does not adhere to the primary peritoneum of the right kidney, so that the great omentum attaches itself to the primary peritoneum, and then continuing its development causes a torsion of itself; or the great omentum becomes adherent to the parietal peritoneum of the right kidney before the ascending mesocolon becomes adherent to it. Any one of the above conditions could easily occur and no symptoms manifest themselves until some inflammation sets in in some other organ or organs of the abdominal cavity.

The great omentum, as in the case herewith reported, may give rise to symptoms of disease of other organs sufficient to demand operation, with few symptoms pointing to itself.

On January 19, 1909, Joseph F., aged forty-two years, white, a locomotive engineer, was referred to Dr. J. D. Griffith, at St. Joseph's Hospital. His family history is negative. He has had all the diseases of childhood, and denied venereal infection. About two months before entrance to the hospital, he noticed a slight aching in his right side when he leaned toward that side or against the cab window; the pain was just between the crest of the ilium and the lower border of the rib. About one week before entrance he began to feel extremely sore in the right side, with pain radiating toward the back; and some pain in the stomach, with nausea and loss of appetite. Being strong and healthy, he returned to work, but

again had to quit. A doctor told him his gut was clogged and advised him to take castor oil. This opened his bowels well; the pain over the right inguinal region at the so-called McBurney point increased.

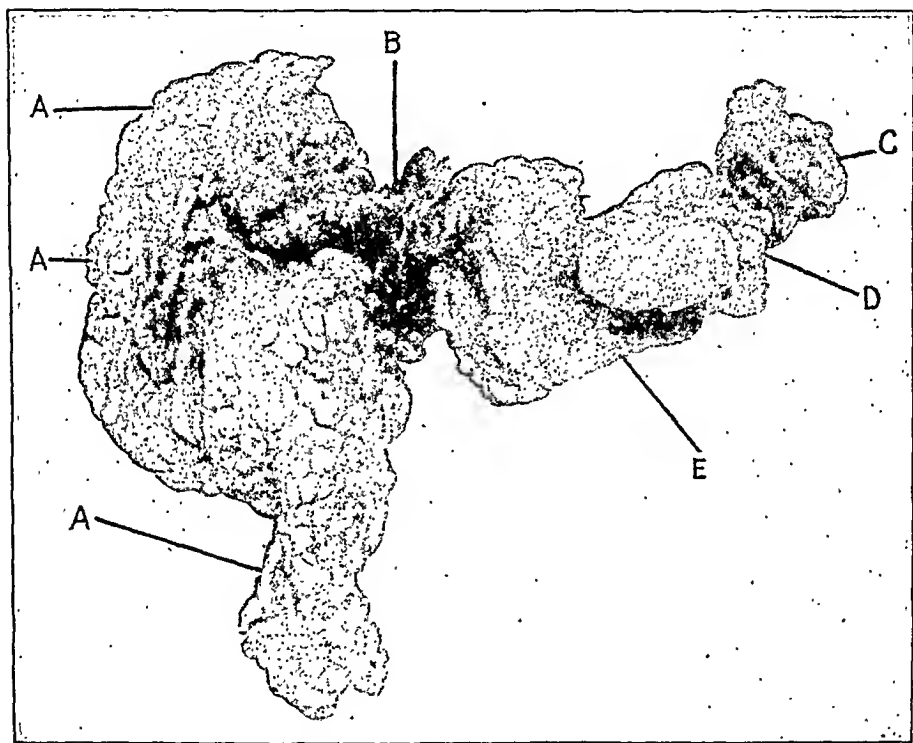
Dr. O'Conner, to whom I am indebted for the privilege of reporting the case, was consulted, and the patient was advised to see his surgeon at once. On examination, there was pain and tenderness over the appendix region, but no tumor was palpable. The right kidney was slightly tender, but no tumor mass could be felt here. The abdominal reflexes were normal. There was no pitting over the anterior superior spine of the ilium, so often found in purulent appendicitis. His temperature on entrance was 99.4°, his pulse 80. There was a slight leukocytosis. The urine was amber in color, the reaction acid; it had a specific gravity of 1020; the daily amount 1500 c.c.; albumin, sugar, bile, and blood were absent. Indican was slightly increased.

A diagnosis of appendicitis was made. The next morning I found that the patient had had a bad night, the pains had increased, his temperature was 100° and the pulse 98. An operation was thought advisable. Under ether anesthesia, an oblique incision about three inches long was made over the appendix region. On introducing the fingers the cecum with the appendix was found adherent to the posterior abdominal wall. After the adhesions had been broken up, a large inflamed appendix was removed. The stump was inverted with a purse string suture after the appendix was ligated off. On returning the cecum and attempting to bring down the great omentum, this was found to be adherent over and behind the cecum or ascending colon. The incision was made larger and the great omentum brought up into view. The point of adhesion was found to be just over the right kidney, the omentum was here twisted on itself, the bloodvessels greatly engorged, and the part at the point of adhesion—the side and not the lower free border—was dark and gangrenous. The adhesions were broken up and the peritoneum sutured over the raw surface. The constricted part of the omentum was ligated off and removed. The accompanying photograph shows the amount removed and the tortuous condition of the great omentum. The omentum was then pulled down and the wound closed. The patient made an uninterrupted recovery.

I have already stated that the patient gave no symptoms of this condition of the omentum, but he did. He complained of pain in the right lumbar region, which increased when he leaned against the window of his cab, or toward that side. However, we often find this is the case in appendicular trouble, and for that reason not enough weight was laid on this symptom.

I found the great omentum covering the ascending colon, a reason for my believing the condition to be congenital, because, as a rule, we do not find it covering that part of the large gut, unless, as I have

said there has been some severe injury to the part; he gave no such history, nor did the gut or kidney region show any signs of injury or inflammatory process. Another very peculiar condition existed: there was no constriction of the gut; it was freely movable under the great omentum, and there was no evidence of bands, which might cause a constriction of the large gut. The soreness in the stomach and vomiting of the patient are explained by the great omentum pulling down on this organ; but the symptoms aided us little in diagnosing torsion of the great omentum, as this condition is also found in appendicitis. I might say, then, that the pain in the



The points A A A, indicate where the specimen was severed from the side of the great omentum; B, the point of greatest constriction wherein were dilated vessels and fibrous tissue; C, the part that was attached to the peritoneum covering the right kidney; D, the gangrenous portions of the specimen; E, the twisted condition of the portion of the omentum from B to E.

right lumbar region radiating to the front and increased on pressure might lead us to diagnosticate this condition, but these are also found when we have trouble in the kidney. I believe, therefore, that we are unable at present to make a positive diagnosis of this very interesting condition until we open the abdomen, and I believe it is often overlooked.

W. W. Grant, of Denver, in 1908, reported a great number of cases of strangulation of the great omentum from pressure or adhesions. I have had four cases, but they were different from the condi-

tions found in the case reported. I agree with Dr. Grant that the condition does not constitute torsion and should not be classified as such. Grant's cases differ from mine in that he could withdraw the mass with intestine from the abdomen. In my case the omentum was firmly adherent to the peritoneum covering the right kidney and had to be gently dissected off. In his case, as in practically every case reported, it was at the lower free end of the great omentum where the torsion occurred. In my case, it was one side of the great omentum, the free edge being free in the abdominal cavity. His case also gives a history of a hernia at one time, which may have been the cause of setting up some inflammation of the gut, in consequence of which the great omentum became adherent without giving any symptoms. Richardson,¹ of Los Angeles, gives a very thorough description of torsion of the great omentum with a very good classification and definition of the condition. In the case reported the torsion was evidently acute and due to a hernia, as a result of an operation. He states "that the true torsion of the omentum should include only those cases in which twisting of the omentum on itself has caused a sufficient obstruction of the circulation to produce evidences of strangulation, excluding those cases where we have a matting of the omentum into a mass or ball, which produces torsion, also excluding cases where there is strangulation from any other causes than twisting of the omentum." Many cases of so-called torsion of the omentum do not fulfil this definition. Richardson's classification into acute and chronic cases is very good, but I think that the chronic cases are not of secondary interest, because they often seem, at some time, to give rise to acute symptoms. In my case the patient had had mild symptoms for some time; suddenly the symptoms became acute; in fact, so acute that a diagnosis of acute appendicitis was made and operation advised. As stated, the appendix inflammation, starting a general peritonitis (mild), may have caused an acute engorgement of the vessels of the great omentum, which gave the symptoms spoken of; but the great omentum at the point of adhesion below the point of twisting and constriction was gangrenous with very dilated vessels above. I am, therefore, inclined to think that the chronic cases are quite important.

Richardson's discussion of the etiology and mechanism is very clear, but in his case a hernia existed; in the cases reported by Corner and Pinches there seems to be some doubt as to the existence of a hernia, but in my case there was no hernia. There was no tumor to cause a matting or balling; the peritoneum, however, was slightly thickened, yet no reason for this could be found, and it may have been due to the adhesions of the great omentum.

¹ Jour. Amer. Med. Assoc., May 17, 1907.

THE THEORETICAL CONSIDERATION OF THE WASSERMANN REACTION AND ITS PRACTICAL APPLICATION.

BASED UPON A STUDY OF 2750 CASES.

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THE reactions based upon the Bordet and Gengou phenomenon applied to syphilis by Wassermann and modified by many others depends upon two factors: (1) The syphilitic serum is said to possess the power of binding or deviating complement when brought in contact with the antigen. (2) The hemolytic system, consisting of any blood corpuscles plus their hemolytic amboceptor—added subsequently or rather after the deviation of the complement is more or less complete—gives no hemolysis.

The Bordet-Gengou reaction is perfectly in accord with the principles of Ehrlich, and in every respect fits the laws of the side-chain theory. Although ingeniously applied, the Wassermann reaction in its first stage, where the complement is presumably bound by a specific antibody and its antigen, in no particular fits the principles of the receptor theory; nor is it at all as specific as the phenomenon that inspired Wassermann to apply it to syphilitic sera. This view of the reaction forces itself upon the worker very early, especially while preparing his extract from non-specific organs.

As is well known, typhoid serum plus bacillus typhosus will bind complement. It is perfectly just to surmise that a syphilitic serum plus the syphilitic incitor will also bind complement. Wassermann thought that in the absence of culturable organisms extracts from the livers of syphilitic foetuses will admirably fulfil all the functions of a specific antigen. When tried in the actual test, this really proved of great efficiency. A few years later its specificity was fundamentally shaken, for investigators found that sera undoubtedly non-syphilitic were capable of binding complement when brought in contact with the extracts from syphilitic livers. It was also shown that extracts from non-syphilitic organs, and substances whose composition does not in the least justify the appellation of antigen, were capable of deviating complement when brought in contact with specific sera. We have here, therefore, sufficient ground to argue the non-existence of antigenic properties in the inhibitory extracts used and the absence of specific amboceptors or antibodies in the complement-binding reaction according to Wassermann.

Absence of True Antigenic Properties. As is well known, an antigen is a body which when introduced into the circulation of

a susceptible organism is capable of stimulating that organism in a specific manner, with the production in the serum of the said animal of demonstrable specific substances, known as antibodies.

Does the so-called antigen used in the Wassermann reaction fulfil the above requirement? To my knowledge, not in the least. In order to explain the action of the so-called antigen, we will have to go back to its standardization. One unit of antigen is the accepted dose. Its size is established by using a syphilitic series of tubes, each receiving, say, from 0.025 c.c. up to 0.2 c.c. of the given antigen dilution, as the case may be; and the same procedure is carried out with a normal serum. The tubes are incubated at 37° plus 0.1 c.c. complement, and at the end of one hour the contents are tested for the presence of available complement by introducing cells plus their amboceptor. At the end of this time most, if not all, of the normal tubes will have hemolyzed. Not so with the syphilitic serum. Here we may note that the tubes containing the smallest amount of inhibitory extract may have hemolyzed, while those containing a larger quantity are more and more opaque as the highest quantity is reached. One may use a series up to 0.5 c.c. and even more. The dose can be made so large that it will prevent hemolysis even with normal sera. We learn from this that the usefulness of the so-called antigen depends upon the property of preventing hemolysis with sera and also upon the precision with which the dose of one unit is established. Its specificity as regards the production of antibody can be entirely dismissed, for it is highly improbable that the inhibitory extract capable of binding complement with luetic sera should also find analogous substances in the sera of scarlet, lepra, trypanosomiasis and scleroderma sufferers. The reaction is not a specific one, and needs thorough investigation as to its *modus operandi*. It seems to me that in the sera of the above-mentioned diseases substances develop which are capable of increasing the inhibitory powers of the extract and thus enhance its antihemolytic properties. The manner in which this is accomplished is only a matter of conjecture. It cannot be denied, however, that antibody formation does take place after the implantation of the syphilitic incitor, but that this true luetic antibody has very little to do with the deviation of complement. In order to give a satisfactory explanation as to the manner in which fixation takes place—bearing in mind the various diseases capable of giving a positive reaction—one must take for granted that in syphilis, as well as in other diseases in no way related to syphilis, other substances are formed besides the specific antibody. These other substances are capable, when brought in contact with the so-called antigen, of liberating a third substance from it, which neutralizes, deviates, and inhibits complementary functions. The formation of these other bodies

is constant in syphilis and in leprosy, and may also form in various other diseases, but less uniformly. We have here a logical deduction based on various well-established facts not conflicting with any of the phenomena of complement inhibition, but specially minimizing its specificity. The only true antibody, antigen factor in the test is contained in the hemolytic system, namely, the antishoop or antihuman amboceptor, sheep or human corpuscles.

The various extracts used as antigens contain the substance which is rendered active only subsequent to the addition of serum carrying the necessary quantity of bodies resulting from an infection by certain germs—these bodies, however, not representing the true antibody. Lately, one of the German workers injected luetic extract into a rabbit and could not demonstrate even a trace of antibody in its serum. It may be that the rabbit is not susceptible to such injection. It is also a known fact that those who worked with extracts from luetic foetal livers—sucking up into the mouth some of the antigen—would not react in any way. I and those who worked with me had the accident more than once without any bad effects. Again, if we should hold responsible a true luetic antibody for the deviation of complement, we must also allow its presence in the sera from all leprosy, and trypanosomiasis patients, as well as in some other truly non-luetic conditions. We would also have to ascribe to the extract the power of producing luetic antibody. Neither requirement is fulfilled in the Wassermann test, therefore we are obliged to look for other factors which would in a less conflicting manner answer most or all of the problems evolved. The possibility of the presence of other bodies in the serum of the clinical states mentioned seems to me rational and most likely the true state of affairs. From the number (2930) of analyses carried out in the Montefiore Home Laboratory, I believe that a syphilitic infection—after subsidence of acute manifestations and its gradation into secondary or tertiary stages—produces changes in various organs, preëminently the liver and heart; that these organs, primarily affected by the syphilitic virus or antigen, ever after this serve as depots of the antigen, of course in a much modified form. These organs furnish the true luetic antibody, in accordance with Ehrlich's theory, as well as other bodies of an unknown chemical and biological nature. These depots are differently affected by the syphilitic virus, depending upon the patient's constitution. The stronger the individual resistance and the milder the infection the sooner do the manifestations disappear and the quicker does the reaction become negative after appropriate treatment. Mercury in proper dosage does away with the reaction as well as most of the symptoms. It may be that the antigen depots are affected by the treatment so that no more are furnished to the serum capable of liberating the inhibitory principle from the antigen used, or, that

subject with a more palpable knowledge of the phenomena at the bottom of the reaction. At present, we possess very few facts as to the real value of the reaction, hence the disappointment experienced by many who expected to find in the test the solution of many an obscure clinical problem.

The majority of sera submitted for investigation and analysis are for diagnostic purposes. The question asked, is the serum from a patient with syphilis or not? Bearing in mind the facts stated before, I believe it is not just or safe to render a decision either one way or the other. It must be remembered that in the absence of bile in the serum—and if one can exclude the various clinical conditions before mentioned—a positive reaction certainly means syphilis. A very important fact must also not be forgotten, and that is, that certain luetic sera give a negative reaction; therefore a negative result for diagnostic purposes is valueless and for the reason above stated. This was known from the very earliest, when the test was carried out in but a few laboratories abroad. The serologist, nevertheless, is often reproached for rendering a negative report in just such cases. I therefore advise to send sera for diagnosis only when the clinical findings are extremely obscure, and even in such a case only a positive reaction is of help; a negative reaction leaves the clinician in the same quandary as before. Knowing the shortcomings of the test, the doctor in such a case must form his own conclusion, or give the patient the benefit of the doubt and treat him for lues—unless time is a factor and more urgent interference is necessary. This is especially true in surgical conditions of the brain and spinal cord. I believe that, whenever time permits—in other words, when alarming symptoms do not urge an operation—the patient is to be thoroughly mercurialized and the least improvement noted. If no improvement is apparent—plus a previous negative reaction—the underlying cause is likely not syphilis, and operative interference is justifiable. Surgical skill is also to be resorted to when the reaction is positive in cases in which the syphilitic deposit is accessible with safety and without injury to neighboring tissues, but it is advisable to exhibit mercury first even in such cases.

The diagnosis of syphilis under certain conditions is circumstantially a matter of some difficulty from the initial lesion to tertiary or late manifestations. I do not include signs that are incontrovertible; I refer here only to symptoms and appearances that are confusing. Sera from such patients are to be submitted—with a thorough history of previous treatment—to exclude the neutralizing effect of mercury, the iodides, or arsenic. Compound cathartic pills, if taken regularly, will make a serum negative. It is not fair to send a serum from a treated patient for diagnosis and not acquaint the serologist with these facts. Such sera from treated patients are to be designated, test serum for therapeutic

efficiency. The results obtained by the serologist and the report submitted with such a knowledge is of greater help to the doctor, as under such conditions, from previous experiences, the laboratory worker can better guide the therapist as to the dosage to be employed in overcoming the symptoms, or eliminating the reaction from the serum. Having on a previous occasion determined the positiveness of a certain serum, a negative reaction after a course of treatment is of great help to the clinician, and it may be stated that even in such a case a negative reaction, although desirable, does not always go with the cure of the condition. First, the patient may have another disease antedating the syphilitic infection, or the serum became negative before all of the subjective and objective signs have disappeared. Whatever the case may be, care must be exercised. It is not at all impossible for a glioma to be quiescent for a certain period of time, due to its location or its size, permitting the host to be more or less active. It is also possible for such an individual to contract syphilis. The glioma will continue to grow, produce symptoms; subsequently its location is ascertained, but the serum, nevertheless, gives a positive reaction. After a course of treatment, the reaction becomes negative, but the tumor symptoms still persist. An operation reveals the true nature of the growth, trying the ability of the serologist. It is very plain that in such a case the laboratory expert is not to be blamed, and that a patient may have had in an incipient stage a more fatal disease than syphilis.

It happens often that a doctor wishes to know the reaction of a certain serum in the course of treatment before the patient is discharged. It has been my experience that such curiosity is unwarranted and not to be practised. A serum reaction, after proper therapeutic measures, is of value only when all subjective and objective signs have disappeared, and not sooner. A negative reaction is very often obtained much sooner than a complete cure, and only serves to confuse the clinician. When the patient is clinically well it is time to perform the test. If the reaction is negative, he may be considered well and discharged with instructions to return in three months and have his serum tested. This is to be repeated, and the reappearance of the reaction, even in a mild degree, is to be followed by appropriate therapeutic measures. It has been the custom to be satisfied when the patient's serum reacted negatively with a mild improvement in the clinical signs. This again makes me bring out the contention that the bedside and not the laboratory is the proper place for making diagnoses as well as pronouncing cures. A negative Wassermann reaction does not signify that the patient is rid of his syphilis, for long before all of the symptoms vanish the reaction may be as above stated. It occurred to me, from a great many tests, that there are numerous gradations from a weakly positive to a decidedly negative reaction.

As shown in Table III, the serum may become negative after a few weeks of appropriate treatment. The patient was by no means cured. His serum added to another positive serum did not behave like the serum from the patient in Table II. I advised to push the treatment until a result as in Table II could be obtained. This actually occurred a short time ago, and his serum was not only negative, but when added to another positive serum behaved as in Table IV; in other words, exactly like a normal serum.

TABLE V.—RESULT WHEN A NEGATIVELY REACTING SERUM FROM A THOROUGHLY MERCURIALIZED LUETIC SUBJECT IS ADDED TO A POSITIVE SERUM.

<i>Hg. luetic serum.</i>	<i>Luetic serum.</i>				<i>Hemolysis.</i>
0.1 c.c.	0.05 c.c.	Incubator at 37° for 20 minutes.	Remaining technique as in Wassermann	Complete.	Complete.
0.2 c.c.	0.05 c.c.				Complete.
0.3 c.c.	0.05 c.c.				Complete.
0.4 c.c.	0.05 c.c.				Complete.
0.5 c.c.	0.05 c.c.				Complete.

I advise the performance of such a test in every case submitted for therapeutic efficiency, for it appears to me logically as well as from observation worthy of trial.

Before closing, I wish to draw the attention of those who are actually engaged in performing tests with the Wassermann and Noguchi systems. Although older and better known, I personally feel that the system recommended by Dr. Noguchi appears much earlier as an indicator of syphilis than that championed by the Wassermann school. The reaction is a little oversensitive, but when carried out with proper knowledge of the technique the percentage of error in my hands was 2 per cent. or less. The Wassermann test showed at best 7 per cent. of negative reactions in well-authenticated luetic conditions. The Noguchi system can also be utilized to a greater advantage therapeutically. Having obtained, on a previous occasion, a positive reaction with this method, it persists much longer after treatment, sometimes remaining positive for weeks after the Wassermann reaction becomes negative. It also rarely gives a positive reaction with sera from jaundiced individuals. Its simplicity, as well as the mode of keeping the biological reagents, makes it a desirable addition to the serological methods.

I had the opportunity to observe and compare the appearance and disappearance of the Wassermann and Noguchi reactions in four cases of very early chancres, and found an average as the appended table shows:

TABLE VI.—WASSERMANN SYSTEM.

<i>Sore noted from 5 to 10 days.</i>	<i>3 weeks chancre no therapy.</i>	<i>Treated for 10 days rubbing.</i>	<i>Treated for 4 weeks rubbing.</i>
3 cases, reaction negative; 1 positive	All positive	2 negative 1 weakly positive 1 positive	All negative.

NOGUCHI SYSTEM.

<i>Sore noted from 5 to 10 days.</i>	<i>3 weeks chancre no therapy.</i>	<i>Treated for 10 days rubbing.</i>	<i>Treated for 4 weeks rubbing.</i>
3 cases positive	All positive	3 positive	1 positive.
1 case weak reaction		1 weakly positive	2 weakly positive. 1 negative.

The above tends to point toward a greater sensitiveness of the system introduced by Noguchi, and in my opinion is very good for therapeutic uses. When used alone, I believe one can depend upon the results obtained by less-advanced workers, provided the laboratory report is used as a therapeutic guide. For diagnosis, I prefer the use of both systems, repeated twice.

My conclusions derived from the foregoing data are as follows:

1. Not only syphilis, but many other conditions give a positive Wassermann reaction.

2. It is not, strictly speaking, specific for syphilis.

3. It is also not specific in the sense of Ehrlich.

4. For diagnostic purposes a negative reaction is of value only when the patient shows signs resembling an initial lesion, or symptoms bordering on this period.

5. In my experience neither the Wassermann nor the Noguchi systems alone are sufficiently accurate for diagnostic purposes. Both systems are to be used.

6. Having excluded the conditions mentioned in the beginning of this paper, a decidedly positive reaction with both methods is highly suggestive of syphilis even if no direct history of an infection is obtainable.

7. It is of no value to perform the test on sera without acquainting the serologist with the therapy.

8. A negative Wassermann reaction is no indication for cessation of treatment. A much better therapeutic gauge, in my opinion, is the experiment suggested in Table IV.

9. Results from different workers will have to differ until the technique becomes more uniform.

Having been aided in this work by a large number of physicians in the city of New York and its immediate neighborhood, as well as from remote cities, who were kind enough personally to help me to carry out my researches, as well as to supply most of the material, I take this instance to thank them singly and collectively.

My special thanks, however, are due to the visiting staff and resident physicians of the Montefiore Home proper, as well as its board of directors, whose generosity in furnishing the funds necessary for such special work enabled me to carry on the work uninterruptedly.

CALCIUM METABOLISM, WITH SPECIAL REFERENCE TO EXOPHTHALMIC GOITRE.

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IN recent years much attention has been paid to the inorganic salts of the body, and many metabolism records of health and disease include estimations of calcium and magnesium and some of sodium and potassium. Besides the consideration of the metabolism phenomena, the pharmacological effect of the minerals and the mineral content of the tissues has been studied. The result of this widespread interest has been the accumulation of a large amount of material. No large work has been inaugurated in this field as was done by the United States Government in the case of nitrogen, and general principles must be deduced from a consideration of all the work collected. Calcium occurs in sufficiently large quantities to make the necessary error of all metabolism work a small percentage of the whole amount, and the process of quantitative estimation is not difficult; hence, the number of calcium records available as compared with those of other minerals is large. The special problems of metabolism, absorption, equilibrium, etc., are as indefinite with reference to calcium as uncorrelated results can make them. For this reason, and because the results of my own experiments can only be interpreted by a comparison with those of others, it seemed necessary to sum up as briefly as possible the work which has been done on these points.

In regard to the degree of absorption there is an insuperable difficulty. Voit¹ found, when he fed an animal on a diet containing a small amount of calcium, that he obtained more calcium in the feces than was contained in the food; he concluded that calcium was excreted by the intestinal wall. The import of this finding was more fully understood when Rey,² having cleared the intestinal canal of animals, gave subcutaneous injections of a calcium salt; he learned by this method that the amount excreted by the intestinal wall might reach over 50 per cent. of the intake, but that the variation was great. There remains the consideration of the balance obtained by deducting from the calcium intake the urinary and gross fecal output without reference to the part of this which is used in the body processes. This balance has been found to be affected by the following conditions: (1) Underfeeding or overfeeding with reference to the physiological requirement; (2) starvation; and (3) pathological conditions.

¹ *Ztschr. f. Biol.*, 1880, xvi.

² *Arch. f. exp. Pathol. u. Pharm.*, 1895, xxxv.

The physiological requirement has been estimated variously. Bunge³ thought that 3.3 grams CaO was necessary each day; Bertram⁴ found himself in equilibrium at 0.38 gram CaO for the two days which he followed his metabolism; more recently Renvall⁵ did an experiment on himself covering a period of fifteen days; this is the longest and most convincing record of calcium metabolism in a normal person. Taking 0.85 to 0.9 gram CaO a day, Renvall found that there was a daily variable loss or gain in the hundredths of a gram; since he weighed 62 kilograms, this gives 0.014 gram CaO per kilo of body weight each day for an adult.

A large amount of work has been done on underfeeding in animals; since rickets and osteomalacia were the most striking examples of calcium disturbance in human pathology, it was natural that they should be the objective point of experimental work. In 1880 Voit was able to accomplish what others had tried with varying success. He reduced the calcium intake of puppies to its lowest terms, and found that after a period of from one to four months, depending on the size of the breed of dog used, the muscle and fat were normal; but the bones were vascular, porous, fractured and fissured in places, and the teeth were imperfect. His calcium-poor diet contained about 0.05 gram CaO daily, and the normal 0.7 gram CaO each day. Though he thought he had produced rickets experimentally, later work showed that there were important differences between the two conditions; but he did show that in the growing organism the lack of calcium is felt most by the bones. Goitein⁶ found the physiological requirement of a rabbit to be 0.16 gram CaO per kilo of body weight daily. He concluded from the results he obtained when he varied this amount that with a calcium-poor diet there was a calcium loss, and with a calcium-rich diet there was a calcium retention. The first half of this conclusion for rabbits has been sustained for human beings in calcium underfeeding by the work of von Wendt.⁷ He found that a constant loss of calcium up to 0.1 to 0.2 gram a day accompanied a diet containing 0.05 to 0.1 gram daily. Müller⁸ and his colleagues found that the calcium output of a starving man was greater than the calcium content of the drinking water.

The subject of calcium overfeeding has been approached by the following workers: Bertram (1897) took 30 grams of the carbonate; he recovered it partly, unchanged in the feces, which showed white with the grains of the salt contained. Herxheimer⁹ (1897) also observed himself, and took the carbonate, 18 grams for five days, and 6 grams for the following three days, in the form of a bread

³ Albu. Neuberg, Mineralstoffwechsel.

⁴ Ztschr. f. Biol., 1878, xiv.

⁵ Skand. Archiv f. Phys., 1904, xvi.

⁶ Archiv f. d. gesamt. Phys., 1906.

⁷ Skand. Archiv f. Phys., 1905.

⁸ Ztschr. f. Biol., xx; Virchow's Archiv, 1893, cxxxi.

⁹ Berl. klin. Woch., 1897, No. 20.

that was manufactured for metabolism disorders. He found a retention of 15.9 grams CaO in the eight days of the experiment. Kaufmann and Mohr¹⁰ (1903) obtained the calcium balance of two patients in the hospital who had no demonstrable lesion. Milk was given in addition to other things, and the calcium intake in one case was 6 grams CaO and in the other 4.4 grams daily. The former retained 16 grams in seven days and the latter 20 grams CaO in ten days. Renvall (1904), in an experiment on himself, used the carbonate in small doses; after the fifteen days of normal metabolism record, referred to under the physiological requirement, he began with 0.5 gram of the carbonate, and retained steadily and continued to do so when he increased the amount to 1 gram. He reached equilibrium about seventeen days after he began to take the carbonate. Thus, the latter half of Goitein's conclusion is supported by four experiments on human beings; a calcium-rich diet (one containing over 2 grams CaO a day) is followed by a calcium retention.

Before passing to the consideration of pathological conditions, one other point must be mentioned which seems, in the few cases in which it has been tried, to affect the calcium balance. The addition of sodium chloride in any appreciable amount appears to increase the calcium output. This is shown by Marischler's¹¹ work in nephritis and Moraczewski's¹² in carcinoma. The former followed the metabolism of 7 cases of nephritis for nine days each; he divided the whole time into periods of three days each, and gave 6 grams NaCl daily on the second set of three days. In 5 of the 7 cases there was an immediate drop in the calcium retention, or a small retention was converted into a loss. The latter added 10 grams NaCl to the diet of a patient having carcinoma; the calcium balance became negative, though it had been positive on the same calcium intake before the NaCl administration was begun. He obtained a different result in his case of chlorosis, but the NaCl period here followed the administration of so many other salts that the picture is not clear. The pathological conditions have been studied almost entirely from the standpoint of calcium overfeeding, not so much intentionally as because this is an accompaniment of the milk diet, which is both an easy form of nutrition for metabolism work and indicated in many forms of disease.

Rumpf¹³ (1897) obtained the calcium balance of a girl, aged nineteen years, who had a stomach ulcer. She was on a milk diet, and received 3.3 grams CaO a day; she retained 1.8 grams CaO daily.

Moraczewski¹⁴ (1901) found a constant negative balance in a case of diabetes with an intake of 1.6 grams CaO a day in the food.

¹⁰ Berl. klin. Woch., 1903, No. 8.

¹² Zeit. f. klin. Med., 1898, xxxiv.

¹⁴ Zeit. f. klin. Med., 1897, xxxiii.

¹¹ Archiv f. Verdauungsk., 1901.

¹³ Berl. klin. Woch., 1897, No. 13.

He changed this to a positive balance by adding 10 grams of the phosphate of calcium and bringing the whole intake up to 5.3 grams a day; the withdrawal of the phosphate was immediately followed by a loss which was a second time counteracted by administering the phosphate, this time in smaller doses; in five days, with an intake of 2.3 grams daily, there was a retention of 2.15 grams.

Ott¹⁵ (1901) worked with phthisical subjects, and found a positive balance in 7 out of 8 cases.

Hirsler and von Terray¹⁶ (1905) followed a case of endo-arteritis, a male, aged fifty-seven years. They divided a six-day period into two of three days each; they gave milk in the first period and added bone meal in the second; the patient retained 3.9 grams CaO in the first three days and 5.3 grams CaO in the second period.

King¹⁷ (1907) followed the metabolism of a case of arthritis deformans; the Folin diet was used, and found to contain an average of 4.6 grams CaO in a day; in the five days of the experiment there was a retention of 9.6 grams CaO.

A calcium loss was found in diabetes by both Moraczewski and Gerhardt and Schlesinger;¹⁸ in the latter work at least there was a coincident factor, which occurs in other pathological conditions, and has always been found to be accompanied by a calcium loss; that is, acidosis. Besides this work of Gerhardt and Schlesinger's there is the record of a case of acidosis of unknown origin obtained by Barker and Voegtlin;¹⁹ in this case there was a high organic acidity, and the chief output was through the intestine. Falta and Whitney,²⁰ after the extirpation of the pancreas of a dog, found an increase of the output of the calcium in the urine. The ammonia was not estimated, but the uric acid rose considerably, and a state of acidosis seemed likely, due either to the removal of the pancreas or to a postoperative acidosis. Some work has been done on the administration of acid by the mouth. Rüdel²¹ gave dilute hydrochloric acid to a child and obtained an increase of the calcium of the urine; later, he gave concentrated HCl to a dog, and found a still greater increase of the output of CaO. Gaeltgens²² observed a dog for nine days, and in the second group of three days gave sulphuric acid; the ammonia rose to three times its former value, and the urinary calcium was increased. He quotes Kurtz as having given sulphuric acid and having a general increase in the output of the salts; potassium was the one most affected, but calcium, magnesium, and sodium were all increased. The ratio of the urinary and fecal output of calcium has always been of interest, though it is of limited significance

¹⁵ Deutsch. Archiv f. klin. Med., lxx, and Zeit. f. klin. Med., l.

¹⁶ Zeit. f. klin. Med., 1905, lvii.

¹⁷ Johns Hopkins Hosp. Bull., June-July, 1907.

¹⁸ Arch. f. exp. Path. u. Pharm., xlii. ¹⁹ Johns Hopkins Hosp. Bull., June-July, 1907.

²⁰ Beitr. z. chem. Phys. u. Path., 1908.

²¹ Arch. f. exp. Path. u. Pharm., 1894, xxxiii.

²² Zeit. f. phys. Chem., 1880.

as an indication of the degree of absorption. By arranging the results of the metabolism work in the form of a table, we see that on an intake of 4 to 6 grams CaO daily the fecal output ranges between 85 per cent. and 95 per cent. of the whole output; the exceptions to this are King's case of arthritis and one of the cases of chlorosis in which it was 70 per cent. Renvall showed a high urinary output up to the time he began to take the carbonate; in the first two periods 60 per cent. and 64 per cent. were excreted through the kidneys. In Gerhardt's case of diabetes, in the period in which the acidosis was not combated by the alkali, the urinary output of calcium rose to 73 per cent. of the whole output. There is a certain amount of agreement between the cases on an intake of 1 to 2 grams CaO daily; many of them have approximately 60 per cent. of the output fecal and 40 per cent. urinary. This is, however, by no means universal; all the carcinomas and several of the chlorotic cases differ from it very markedly.

TABLE I.

Author.	Daily intake in grams CaO.	Urinary per cent.		Author.	Daily intake in grams CaO.	Urinary per cent.	
		Urinary	Fecal			Urinary	Fecal
Van Wendt	Normal, 0.05	10.0	90.0	Mayer	Phthisis, 1.5	40	60
"	" 0.2	21.0	79.0	"	" 2.0	37	63
Renvall	" 0.85	60.9	39.1	Moraczewski	Carcinoma	11	89
"	" 0.9	64.3	35.7	"	10 gms. Ca ₃ (PO ₄)		
"	" 0.9	29.1	70.9	"	Carcinoma, 1.3	13	87
"	" 0.9	36.1	63.9	"	" 1.3	6	94
"	" 0.9	25.4	74.6	"	" 1.3	9	91
Herxheimer	" 11.6	7.5	92.0	"	" 1.3	12	88
"	" 3.7	12.4	87.0	"	" 2.9	5	95
Kaufmann and Mohr	" 6.0	8.0	92.0	"	" 0.9	71	29
"	" 4.5	8.0	92.0	"	Chlorosis,	29	71
"	"			"	+ 10 gms. Ca ₃ (PO ₄)		
King	Arthritis, 4.5	30.5	69.5	"	Chlorosis,	11	89
Barker and Voegtlin	Acidosis	14.3	85.7	"	+ 10 gms. Ca ₃ (PO ₄)		
Gerhardt and Schlesinger	Diabetes, 0.8	38.0	62.0	"	Chlorosis, 0.9	20	80
"	" 0.8	73.0	26.0	"	" 1.3	40	60
"	" 0.8	55.0	45.0	"	" 0.9	40	60
Hirsler and v. Terray	Arteriosclerosis, 5.8	6.9	93.1	"	" 1.4	9	91
"	" 7.2	7.4	92.6	"	" 1.4	39	61
Ott	Phthisis, 4.4	5.0	95.0	"	" 0.9	9	91
"	" 6.1	13.0	87.0	"	" 1.4	4	96
"	" 6.0	6.0	94.0	"	" 1.4	9	91
"	" 4.5	7.0	93.0	"	" 1.4	19	81
"	" 4.5	6.0	94.0	Towles	Hysteria, 0.3	40	60
"	" 2.3	7.0	93.0	"	" 1.2	36	64
"	" 4.0	7.0	93.0	"	" 1.2	39	61
"	" 2.4	6.0	94.0	"	" 1.2	28	72
Mayer	" 1.5	40.0	60.0	"	Exophthalmos, 3.8	16	84
				"	" 3.8	10	90

Table I shows the great variation in the ratio of the urinary and fecal calcium output in normal as well as pathological conditions.

A most important contribution to our knowledge of the course of events in calcium metabolism when a sudden and severe drain is made upon the calcium of the body was made by McCallum and Voegtlin²³ in their article on the "Extirpation of the Parathyroid." They found that after this operation dogs developed symptoms of tetany which disappeared when calcium was administered; analyses of the tissues showed that there was a decrease of the calcium content of the soft parts and the blood. Since the bones were not obviously affected the condition was one in which their calcium was not available, probably because the whole process was too acute.

This consideration of the literature allows the following conclusions to be drawn as far as one may conclude anything from records which cover so short a period as many of those quoted do. Absorption is an unapproachable problem. The physiological requirement is about 0.014 gram CaO per kilo daily for an adult. Underfeeding of calcium is followed by a calcium loss. A diet rich in calcium is followed by a calcium retention. Acidosis is accompanied by a calcium loss.

Since the thyroid gland is so closely associated with metabolism phenomena and cases of exophthalmic goitre were easily obtainable, it seemed advisable to investigate the calcium balance in this condition. The literature of the metabolism of Basedow's disease is given fully in von Noorden's text-book; a considerable number of cases have been followed for the nitrogen metabolism, and the results have been identical; namely, that in most though not all of the cases there is a loss of nitrogen in the later and more severe stages of the disease. No change was found in the chlorides and the phosphates were inconstant, and in no cases had the calcium been determined.

Three weeks was decided upon as the longest time feasible for following the metabolism of a hospital patient; as it was impossible to keep a person on the same diet daily for that length of time, a rotating diet was devised, which contained the same amount of calcium daily, and also as little as possible, that the effect of the calcium salt administered might be evident. The diet consisted of 30 grams of oatmeal weighed raw, 150 grams of bread, 90 grams of butter, 3 grams of salt, 50 grams of sugar, 50 grams of cream, one cup of coffee, 1500 c.c. of water daily; 150 grams of beef, 150 grams of potatoes, 100 grams of spinach; or 150 grams of lamb, 150 grams of rice, 100 grams of peas; or 200 grams of chicken, 150 grams of potatoes, 100 grams of cauliflower on successive days, and repeated in regular order through the weeks of the work.

²³ Jour. Exper. Med., 1909.

At the end of the day, when the residues were weighed out, one-half the quantity actually consumed was weighed for analysis, put through a grinder into an evaporating dish, together with the washings of the grinder itself, and evaporated to dryness on a steam oven and dried at 110° for thirty-six hours, weighed and powdered. The mixture contained six articles daily; the butter was analyzed separately. The same diet was used in both cases. A preliminary period of four days in which no calcium was given preceded the administration of the calcium, which was given in the form of the lactate, and in this first case in doses of 5 grams daily, in capsules. The feces were marked off at the end of four, six, five, and four days, with decalcified charcoal, for the purpose of separating the preliminary period from the rest of the time, and of obtaining the balance at intervals through the calcium taking time. The urine was collected from 7 A.M. to 7 A.M., and all estimations were made on the same day that the material was sent to the laboratory.

The first patient was aged thirty-one years, single, occupied a separate room, and was attended by a special nurse. Physical examination revealed no abnormality, and her difficulty in walking for which she entered the hospital was diagnosed by Prof. Barker as hysterical, and this was subsequently confirmed by her recovery. Unfortunately she was very constipated, and a plain water enema was given daily; in addition to this a purgative was given once during each period (2 drams of castor oil). Her weight, one hundred and forty-eight pounds, was the same at the end as at the beginning of the experiment. Table II shows the food nitrogen and calcium and the urine and feces; also the total acidity, the phosphates, and the ammonia of the urine. The nitrogen was estimated by the method of Kjeldahl, the ammonia by the Folin method, the phosphates by titration with uranium acetate, the total acidity by titration with one-tenth normal NaOH solution with phenolphthalein as an indicator, the calcium was brought down in a solution of acetic acid as the oxalate and titrated as calcium with potassium permanganate.

An accident to the tray on which the patient's meals were served, on the ninth day of the experiment, makes the intake of that day a little uncertain; but the calcium of the food was so small a part of the whole amount that no great error could have occurred. The preliminary period showed a loss of calcium, the first and second periods of the calcium-taking time a slight retention; the urinary calcium was of a higher daily average than the calcium of the food; in the last period there was a slight loss. The patient had been in the hospital three weeks, and had taken considerable milk in that time, so that the observation follows a period of calcium-rich diet.

TABLE II.
Food.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Nitrogen	10.31	8.09	9.15	14.35	11.40	13.80	9.66	10.81	10.96	9.25	12.68	15.07	9.65	8.17	13.49	9.21	13.85	12.70	12.81
Calcium	0.3517	0.2359	0.4192	0.3126	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909
					0.2022	0.2299	0.4356	0.2862	0.1145	0.3644	0.2359	0.2337	0.4332	0.2283	0.3648	0.3648	0.2328	0.2268	0.2596

URINE.

	1820 c.c.	1090	1300	970	1240	1070	1052	1100	900	1249	910	1225	1545	710	919	1420	1350	1565	1000
Quantity	473	452	318	300	192	214	115	177	207	124	182	214	123	117	188	142	162	125	220
Acidity	0.8635	0.982	0.7403	0.6812	1.001	0.7276	0.4471	0.4320	0.5202	0.4352	0.4486	0.5915	0.3939	0.6095	0.4140	0.4586	0.5622	0.385	0.595
Ammonia	2.82	2.25	1.40	0.714	0.995	1.071	1.01	0.907	1.118	1.29	0.930	1.06	1.13	1.17	1.16	1.24	1.09	0.929	9.57
Phosphates	10.43	14.64	9.35	9.72	8.12	9.73	8.02	6.57	7.75	8.28	7.02	8.37	7.31	7.36	9.69	8.94	9.90	8.76	8.23
Nitrogen	0.5619	0.4327	0.2534	0.2562	0.3762	0.3802	0.4099	0.3921	0.3301	0.3386	0.4306	0.4127	0.4219	0.3251	0.3818	0.3839	0.3557	0.2706	0.3901
Calcium																			

FECES.

	5.4138	4.8069	4.0534	5.6501
Nitrogen	3.2104	3.7913	3.0528	3.7883
Calcium				
Quantity	79 grams	90 grams	70 grams	91 grams

BALANCES.

Nitrogen	-7.6569	+12.5995	+15.2443	+7.0925
Calcium	-3.392	+1.06	+1.0762	-0.4695
Total nitrogen, +27.2792.				Total calcium, -1.7315 (in whole time).
Total calcium, +1.660 (in calcium-taking period).				

The second patient was aged thirty-five years, and weighed 106 pounds; she had a marked case of exophthalmic goitre; there was a large tumor of the thyroid, a pulse rate of 130 to the minute when she entered the hospital, a fine tremor of the fingers, and considerable exophthalmos; there was little sweating; the heart, lungs, and abdomen showed no abnormality; the urine was negative, and the temperature was normal. This patient had also been in the hospital for some time, and had had milk daily. She was given the same diet as the first patient and 20 grams of calcium lactate daily in water flavored with lemon juice. Her pulse rate was 100 to the minute when the work was begun, and no change took place in this; in general, her condition appeared the same; the patient herself thought she was the same, except that an unpleasant sense of constriction had disappeared from about the throat. On the third day of the second period, the first of the calcium taking, the stools of this patient became very green, and remained so through the whole of the time; but were normal as soon as the calcium was stopped. When the time was about half over we learned that the patient was pregnant, in the first weeks. On the two days indicated by a plus sign the urine was partly lost into the feces, so that, though the whole balance is accurate, the ratio of the urinary and fecal output is lost. Subsequently the patient was operated on by Dr. Halsted and made an uninterrupted recovery, and left the hospital much improved. In this case (Table III) the nitrogen balance was positive in the first period by 5.3 grams, in the second period there was a loss of 4.8 grams, and in the third a loss of 11.4 grams, followed by a retention of 3.4 grams; in the whole time a loss of 7 grams and one pound in weight; the patient was hungry most of the time, which she said was usual with her in the early stages of pregnancy. The calcium balance was negative in the first period and showed a retention in the second of 3.7 grams CaO , followed by a loss of 6.6 grams and in the last period a loss of 0.45 gram CaO ; there was a total loss of 5.4 grams CaO . That such a loss of calcium is not an inseparable accompaniment of Basedow's disease is shown by the calcium balance of a patient who suffered with a severe case of exophthalmic goitre; she was aged forty years, and was kept on a diet of 1 liter of milk, 150 grams of beef, and 50 grams of bread; there was a retention of nitrogen; the urinary calcium was low, probably because of a renal insufficiency; the observation lasted eight days; the ammonia and total acidity were normal:

CaO intake.	Urine.	Feces.	Total output.	Balance.
24.48 grams	1.0437	17.5	18.54	+7.94

In this case there was a retention of nearly 1 gram a day on a less intake of CaO in the form of milk.

Shown graphically, the nitrogen and calcium curves in the case in which the calcium lactate was used is as in Charts I and II.

TABLE III.

FOOD.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Nitrogen	12.72	10.21	13.30	9.74	10.20	12.60	12.65	8.64	15.11	9.47	10.83	12.60	10.93	10.45	12.50	12.56	14.40	13.80	11.33
Calcium	0.2361	0.3832	0.2520	0.2520	0.2001	0.2500	0.2084	0.3987	0.2034	0.2494	0.3332	0.2282	0.2157	0.3447	0.2455	0.2165	0.3499	0.2487	0.2325

URINE.

	Quantity	670	1480	910	770	760	700	520	1330	860	1660	1060	960	1260	1020	865	1060	810	1485	1420
Acidity	323	148	264	269	315	255	187	137	234	133	192	79	86	163	86	246	276	129	141	
Ammonia	0.6052	...	0.8315	0.8737	0.9011	0.8181	0.8331	0.7743	0.5957	0.986	0.986	1.103	0.7711	0.6693	0.7326	0.5531	0.8284	0.8185	1.016	
Phosphates	1.519	...	1.361	1.55	1.27	1.05	0.729	1.26	0.94	1.28	1.28	0.93	0.89	1.21	0.88	1.03	1.21	0.82	1.40	
Nitrogen	8.30	5.05	9.75	9.90	10.40	10.68	8.63	12.88	10.26	13.59	14.31	10.14	10.14	14.77	10.24	11.01	14.59	10.17	11.75	5.21
Calcium	0.1485	0.1891	0.2563	0.3452	0.4915	0.4856	0.2216	0.7942	0.5391	0.5233	0.4334	0.4448	0.7008	0.7008	0.3589	0.5638	0.4202	0.5610	0.7065	0.2830

FECES.

	Nitrogen	7.6476	6.7468	8.3377	5.9071
Calcium	2.3387	16.6822	23.6549	14.0739	14.0739
Amount	143 grams	192 grams	215 grams	118 grams	

BALANCES.

	Nitrogen	+5.3173	-4.8213	-11.4905	+3.459
Calcium	-2.1536	+3.7685	+3.7685	-6.6093	-0.4560

Total nitrogen, -7.5055.

Total calcium CaO, -3.2968 (calcium-taking period).

Total calcium CaO, -5.4504 (whole time).

From left to right one square represents a day. The base line is equilibrium. In the nitrogen it is about 11 grams; in the calcium, in the preliminary period, it is 0.22 gram and the rest of the time 3.8 grams CaO; in both substances each square above or below the base line is 1 gram. Evidently the second and third

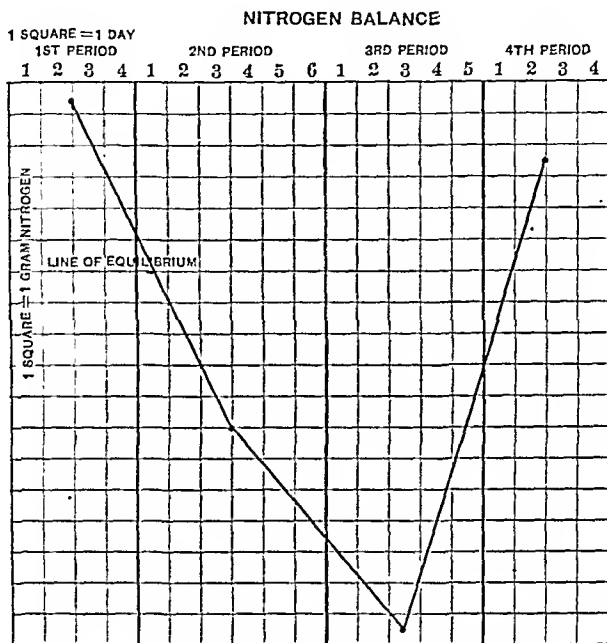


CHART I.—Illustrating the nitrogen balance in Case II.

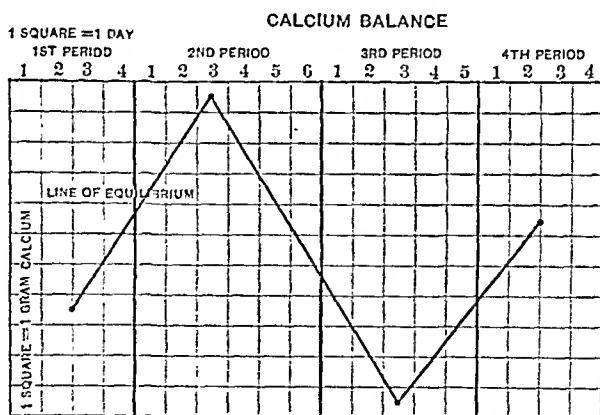


CHART II.—Illustrating the calcium balance in Case II.

periods are coincident with such a wave of metabolism activity as others have observed in this disease, or the loss may be associated with the pregnancy.

Whatever may be the cause of the stimulation of the metabolism, the parallelism of the nitrogen and the calcium is apparent. The

loss of the latter substance in the preliminary period is due to the extremely small intake, the usual picture of underfeeding, and that the retention is much smaller than it would be in a normal individual in nitrogen equilibrium I have no doubt; unfortunately both attempts to establish this point were unavailing, since there were losses in the collections that stopped the work. The influence of the amount of calcium taken and the form in which it is ingested upon the retention of calcium and the relation of the nitrogen balance to this may be seen by arranging the results of the work done on calcium overfeeding in the form of a table (Table IV):

TABLE IV.

Author.	Subject.	Form.	Amount. Grams.	Daily Reten- tion in grams.	Retention. Per cent.	N balance in grams.	No. of days.
Herxheimer	Himself	CaCO ₃	8.0 CaO ₃	1.9	23	4.3	8
Kaufmann	Normal	Milk	6.0 "	2.2	38	34.2	7
"	"	"	4.5 "	2.0	47	56.6	10
Rumpf	Ulc. vent.	"	3.3 "	1.8	56		
King	Arthritis	Folin	4.5 "	1.9	41	5.8	5
Hirsler	Arteriosclerosis	Milk	6.5 Ca	1.5	23	14.4	6
Moraczewski	Diabetes	Cal. phos.	5.3 "	1.8	33	2.39	7
"	"	" "	2.3 "	0.4	10	-18.9	5
"	Chlorosis	" "	5.0 "	3.9	78	42.3	5
"	"	" "	5.3 "	4.1	75	24.1	5
"	Care. vent.	" "	4.3 "	3.1	74	4.3	11
Ott	Phthisis	Milk	4.4 "	0.6	14	0.05	4
"	"	"	6.1 "	0.7	11	-2.39	4
"	"	"	6.0 "	0.1	3	-2.63	4
"	"	"	4.5 "	0.5	11	-3.36	4
"	"	"	4.5 "	0.1	4	-0.08	4
"	"	"	2.3 "	0.1	5	10.0	8
"	"	"	4.0 "	0.2	7	-2.97	3
"	"	"	2.4 "	...	..	0.08	6

The variety of conditions observed and the different amounts and forms of administration used allow but few conclusions to be drawn from this table. It is interesting to note the constancy of the daily retention on an intake of 4 to 6 grams of CaO daily in the form of milk; the agreement of the normal and pathological subjects of observation except diabetes and phthisis; the greater retention of the phosphate; and the parallelism of the nitrogen and calcium balances. It is evident that a loss of calcium may be prevented by a sufficient intake even when there is a large negative balance of nitrogen; this is seen in the second period of the administration of the phosphate in the case of diabetes and in the series of phthisical subjects. That this narrow margin of a positive balance is attained at the price of a considerable diminution of a

possible retention is seen by a comparison with the retention in those cases on the same intake which have a positive nitrogen balance. Recently, Mayer²⁴ has shown that a positive calcium balance occurred without exception in a series of phthisical subjects on an intake of 1.5 to 2 grams CaO in a day when there was a positive nitrogen balance. Von Wendt showed in a physiological case that with a sufficient though moderate nitrogen intake there was a retention of nitrogen together with a loss of calcium with a calcium underfeeding; also that there was a calcium retention on a moderate intake associated with a nitrogen loss due to nitrogen underfeeding. Renvall had an enormous loss of nitrogen through the whole time of his experiment, and was in calcium equilibrium at an intake of 0.9 gram and retained calcium when he made the small additions of the carbonate. He attributed the loss of nitrogen to the diet he was using, and noted that the fecal nitrogen was unduly high, a condition of underfeeding practically. Thus, we see that while the nitrogen and calcium balances may rise and fall together in a general way, it is a phenomenon of disease rather than of health, and has been found to occur in phthisis, diabetes, and exophthalmic goitre; though even here the calcium balance may be made to be positive with a sufficient intake, though not without evidence of the tendency to loss.

In regard to the cases recorded here, the first experiment shows that the lactate is an easily absorbable salt, as the urinary output is higher than the calcium content of the food. The case of exophthalmos shows a retention of only 15 per cent. of the intake in the first period of the administration of the lactate as compared with 38 per cent. and 40 per cent. retentions in other cases in which milk was used containing approximately the same amount of calcium in terms of CaO, and in which there was also a retention of nitrogen. In the next period, with the loss of 11 grams of nitrogen, there was a loss of 6.6 grams of CaO, while in the case of diabetes there was a slight positive balance, though the intake was 2.3 grams of CaO only and the nitrogen loss was 18 grams. What part of this wide difference is due to the pathological conditions and what to the salts used must be determined by further work.

CONCLUSIONS. Calcium given in the form of the lactate enters into the general metabolism or allows the calcium already present in the body to be utilized without loss. Given by the mouth there is no toxic effect from the administration of 20 grams of calcium lactate over a period of fifteen days.

The calcium metabolism of Basedow's disease shows no special peculiarity; it runs parallel with the nitrogen, and in those periods of the disease in which there is a loss of nitrogen there is also a loss of calcium—a parallelism which is found in other pathological conditions.

²⁴ Deut. Archiv f. klin. Med., 1907.

My thanks are due to Prof. Barker for permission to work in his laboratory and with his patients; to Dr. Voegtlin for the preliminary instruction which made it possible ultimately to undertake this work and his interest and advice throughout; to the nurses in charge of the patients, the Misses Richardson, French, and Allen, and to Miss Wilder, of the diet school, through the long and trying period of the weighing.

HOW FAR IS HEREDITY A CAUSE OF AURAL DISEASE?

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SOME five years ago I presented to the Section on Otology of the College of Physicians, but did not publish, a brief note combating the claims made by some authors as to hereditary influences in the causation of ear disease. The subject has considerable practical importance, since we do not wish to waste time upon cases which are foredoomed to afford no success; but also because many people, under an erroneous impression that they are victims of inherited deafness, fail to seek relief at the hands of the surgeon while it is still possible to obtain it. The cure of the chronic catarrhal forms of deafness, not to speak of so-called "otosclerosis," is hard enough at best, and discouragement is all too easy without bringing in imaginary heredity to darken the prospect; yet the claimed bearing of inheritance often seems so far-fetched, if not preposterous, that I again offer a word in opposition,

Just as before I cited two cases of penetration of the drumhead by a twig, and jestingly asked what but heredity had produced this rare accident in cousins, so now it is the close parallelism of conditions in father and son which serves as a text for my remarks. A clergyman came to me nine years ago with Shrapnell perforation and cholesteatoma on the right side and marked defect of hearing from catarrhal deafness on the left. These have yielded none too perfectly to treatment, so that he is still under periodic care, with some tendency to brief recurrence of suppuration in his right antrum, where skin masses collect at intervals until perhaps there is new polyp growth as Nature's protest and effort to expel the collection. Most of the time he is so free from trouble as to be prone to neglect the needed care, while his hearing remains about double what it was on coming, although still imperfect in each ear.

Recently he brought his father because of decrease in hearing, and I found large cholesteatomatous masses protruding from his right antrum and attic, removal of which showed a virtual tympanic exenteration spontaneously done, differing from the

son's only in its greater extent. On the left side there was a depressed drumhead with thin areas, possibly cicatricial, and a stuffy tube, complicated of late by neurasthenic reduction of the acoustic function—conditions almost identical with those found years ago in the son. Eustachian catheterization with dionin has freed his tube, tonic measures have already improved his physique, cleaning up his right tympanum has brought its suppuration to a close, and his hearing on each side seems to be as good as he has known for years.

Heredity is so often dragged in by medical and lay alike in explanation of deafness or the diseases leading to that defect, that it seems only right to meet the claim by renewed query as to how much justification can be adduced for it. Believers in the entity of "otosclerosis" as a *non-sclerotic* disease are apt to cite heredity as one of its most probable factors; and long family trees (of doubtful authenticity to the unenthusiastic mind) are published in support of this contention. Yet it must be conceded by the candid student that the proof of genuine "otosclerosis" is none too positive even in the observed cases, while in most of the unexamined forebears its existence is nearly pure assumption. Deafness marked by exaggerated bone conduction and loss of low tones, with free Eustachian tube, is not necessarily "otosclerosis," even if the drumhead looks normal. The classic definition of amblyopia, in which "the patient perceives a little and the surgeon sees nothing," as sufficiently explaining the defect, ought not to be extended to insidious forms of deafness as diagnostic, especially for the cases which have not even been looked at.

Von Troeltsch told us fifty years ago that one-third of all adults are deaf in one or both ears, and further study has fully confirmed this; and even in the schools 25 per cent. are found deaf. It is a lucky family, therefore, which has not its group of deaf members; and as some families *do* thus escape, there must be an undue proportion in some other families less favorably environed. We could all cite instances of apparent heredity as plausible as those reported; but investigation would quickly prick the bubble in many of them. Those of a family in which four out of five living members showed greater or less deafness a few years ago, were considered by many of their acquaintance as inheriting their deafness. Yet one is a chronic catarrhal case which has advanced little since adult life and permits of some satisfactory hearing at nearly ninety; one an ordnance officer whose defect seemed due to cannonading; one showed defect only about her ninetieth year, with general physical breakdown; and the last has only a trifle of nerve deafness, which interfered little with his usefulness on the bench until his eightieth year, and has not seemed to increase for years. But these are really four children out of eleven, and I can not learn that any of the others showed defect of hearing,

nor that any of their progenitors were deaf, although generally reaching advanced age; and there is no instance of deafness in the younger generation of about a dozen, of whom, however, but two living at over fifty had a deaf parent.

One of my patients, whose condition and history better permit a diagnosis of "otosclerosis" than the majority of the small group which I would so regard, has two sisters also deaf, both with chronic tympanic catarrh in my opinion. On neither side, in the large families behind them, is there known deafness except of one maternal uncle, whose defect did not prevent his serving as an officer through the Civil War, at the close of which he was accidentally killed. I have previously cited this family as an instance of inheritance, for I believe that the children all have the narrow external configuration of the nose of their father, while the internal structures, like those of the larger Roman nose of the maternal side, crowd the nasal cavities and predispose to stenosis and catarrhal troubles. The two brothers have had as much or more nasal affection, but have escaped the ear involvement from which the three sisters have suffered.

A special susceptibility of the mucous membranes seems to be present in some families and to predispose to catarrhal involvement of the nose and ears. Yet it is questionable if this is not largely due to environment except so far as induced by structural configuration, as above indicated, as the sole inheritance. Much more evidence were easily adduced to show that heredity may play an important part anatomically to facilitate or decrease the tendency to ear disease. It is generally recognized that the negro has a wide, straight canal, in which cerumen does not readily collect, while his short, wide Eustachian tube and roomy nose are little prone to catarrhal affections, affording his race a considerable immunity from troubles frequent in the white. Certain families show usually the narrow jaw and high palatal arch which is frequently associated with adenoid hypertrophy of the pharynx vault, and is too often considered a consequence of that condition instead of a cause. I have had to remove wax impactions from the ears of most of the members of one family, all of whom showed a tortuous collapsed canal which must have constituted a predisposition. The straight, open canal of one of my cases of drum-head puncture was surely a factor in facilitating the entrance of the penetrating twig, but it was not present as an inherited feature in his cousin, who similarly suffered.

The assumption of inherited narrowness of the fenestral niches as a factor in fixation of the stapes and round-window membrane lacks confirmatory observations; the claim that spongification of the labyrinth walls has its beginnings in embryonal life is similarly weak; and while Bezold claimed heredity for 52 per cent. of his otosclerosis cases, most students of the matter admit far less, and

Heimann only 9 per cent. A stronger case might really be made for other diseases of the ear, or for those of other organs. Predisposition alone can fairly be claimed as a matter of inheritance in ear disease, and the degree of this is not likely to be agreed upon by the authorities.

The environment, therefore, of those presenting a family history of deafness must receive most sedulous attention, and all habits, such as mouth-breathing, which tend to damage the ears, must be early corrected, by adenoid operation or other intervention if necessary. Careful treatment should be instituted as soon as any defect of hearing is recognized, and pursued thoroughly and hopefully, using the measures which have in careful hands always given fair results, instead of "following after new gods"—often new only to a new generation which does not remember their previous exploding. Heredity must not be assumed as an imaginary bar to the treatment of remediable disease in the ear or elsewhere.

REVIEWS.

URGENT SURGERY. By FELIX LEJARS, Professor Agrégé à la Faculté de Médecine de Paris. First English edition, translated from the sixth French edition. Vol. I; 617 pages; 20 full page plates, 994 illustrations. New York: William Wood & Co., 1910.

THE general plan of this well-known book is more comprehensive than its title seems to indicate. So many operations may be "urgent" that, literally interpreted, as it has been, the title may be made to include perhaps the majority of the operations of surgery. Intra-glandular abscess of the breast, abscess in the sheath of the sterno-mastoid, and a few similar conditions, are but rarely the cause of any real urgency, and might with propriety have been omitted. The work is, however, far more than a manual on "First Aid to the Injured," and is, indeed, a treatise which admirably sets forth the accepted French technique in many important operative procedures. That there is little mention of the differences in detail which would be found on comparison with American or with English methods does not materially lessen its value, and, in fact, by adding to the directness and force of the teachings renders them both more available in a real emergency, and more readable. There have been so many foreign editions of the book—which has been translated into almost every Continental language, including Russian, and into Japanese—that an extended review of this translation does not seem to be needed.

For commendation we would select the descriptions of the management of retropharyngeal abscess in which essential details often omitted are particularized; of the indications and procedure in fractures of the larynx; of the operative technique in wounds of the heart; of the treatment of abdominal wounds, non-penetrating and penetrating; and of the whole clinical series of appendix infections and their complications. The author is always positive in his advice, and in his effort to avoid ambiguity sometimes seems to be a trifle too comprehensive, but careful reading usually shows that he can justify the position he has taken, or that he has made the necessary reservations. For example, his teaching as to appendicitis, while radical to the extent of recommending that "every case of acute appendicitis must be operated on," is conservative in that he would wait, "as often as possible," "until a quiescent stage;" and while

he thinks that in abscess cases the appendix "ought to be looked for," he gives minute directions as to the manner of search, and adds: "Stop in good time if nothing is found; the object of the operation is not to resect the appendix, but to open freely and drain the abscess cavity."

Here and there are statements not in accord with received opinions. It is far from certain that, in fractures of the lower jaw, "when the mouth is opened the posterior fragment is automatically depressed," but the description of the Claude Martin treatment for such fractures—"the open mouth" position—is excellent; and his dictum that the "primary indication" in all these fractures is for "frequently repeated and thorough disinfection of the mouth," deserves emphasis and repetition. So too, while in regard to luxations of the inferior maxilla he mentions only the exploded theory that the obstacle preventing reduction is the engagement of the coronoid process in front of the malar bone, his description of the best method of reduction is unexceptionable.

The translation has been well done. We do not know why the author is a "Professor" agrégé, the rest of his titles being in French. The proofreading has been excellent in spite of a few slips, such as "peritoneal" (p. 499). The illustrations are usually instructive. Fig. 206 (p. 216), "application of a diachylon bandage in a case of fractured ribs," perpetuates a perennial error, the patient being shown with his arms raised so that as soon as they were lowered the most skilfully applied strips would surely loosen. But the same mistake may be found in Scudder, in Keen's *Surgery* (Vol. II), and in various text-books on surgery.

On the whole, the book in its English form is to be welcomed by both practical surgeons and general practitioners. It is to be hoped that the second volume will soon follow, as cross references occur in this one which leave the subject under discussion incomplete, such as the reference on page 118 to "Traumatic Hemorrhage," which is not to be found either in the index or the Table of Contents.

J. W. W.

AMERICAN PRACTICE OF SURGERY. Edited by JOSEPH D. BRYANT, M.D., LL.D., and ALBERT H. BUCK, M.D., of New York City. Vol. VI; pp. 916; 631 illustrations. New York: William Wood & Co., 1909

THE sixth volume of the *American Practice of Surgery* continues Part XVI (Regional Surgery), as follows: Prosthesis in its relation to surgery of the face, mouth, jaws, and nasal and laryngeal cavities, by Charles R. Turner, M.D., D.D.S., of Philadelphia; surgical diseases and wounds of the nasal cavities and accessory sinuses, by

Harris P. Mosher, M.D., of Boston, based on good original work, with numerous valuable illustrations; surgery of the mouth, tongue, and salivary glands, by Geo. E. Armstrong, M.D., of Montreal; of the neck, by John M. Elder, M.D., of Montreal; of the thyroid and thymus, by Francis J. Shepherd, M.D., of Montreal; of the thorax and spinal column, by Norman B. Carson, M.D., of St. Louis; of the female breast, by Harvey G. Mudd, M.D., of St. Louis; of the external genitals and vagina of the female (sic!), by William P. Graves, M.D., of Boston; of the male genital organs, by Franklin G. Balch, M.D., of Boston; chancroid, and gonorrhoeal urethritis, by Hugh Cabot, M.D., of Boston, most admirable articles, the latter including the entire subject of strictures; and surgical diseases and wounds of the jaws, by Joseph C. Bloodgood, M.D., of Baltimore.

Among these numerous articles, most of which are of more than average excellence, it is possible to select only a few for extended notice. Turner treats of prosthesis for teeth, cleft palate, and jaws, as well as of artificial noses, lips, ears, tongue, and larynx; no mention is made of the use of paraffin. He urges the use of the prosthesis of Claude Martin, of Lyons, for immediate application after resection of the jaws; though little employed so far in this country, Turner appears firmly convinced of its value.

The most interesting subject discussed by Armstrong is carcinoma of the tongue. He recommends median division of the mandible (formerly known as Sédillot's or as Syme's operation, but lately appropriated by Kocher) only for excision of the entire tongue; for partial excision he uses Whitehead's method; and for cancer of the base or of the lateral posterior aspect of the tongue he prefers Langenbeck's operation. In any case he saws the mandible in a sinuous line, to aid in subsequent coaptation. Perhaps it would have been well if more stress had been laid on bilateral removal of the lymph nodes in all cases. Elder is inclined to conservatism in the treatment of tuberculous cervical lymph nodes. Tumors of the carotid body are not mentioned, though they seem to belong in this article.

Shepherd's article on the thyroid covers nearly fifty pages. He does not tell what the parathyroids are; perhaps this is because he does not know. Certainly, no one else seems to have any clear ideas on the subject; but as he believes that goitre is caused by a microbe yet unknown, it would have been interesting to learn what he thinks of the parathyroids. He discusses *diagnosis* before *symptoms*, and these latter before *classification* or *pathology*; but as the pathology, and therefore the proper treatment, of affections of the thyroid is one of the most difficult problems in surgery today, it is not strange that no thoroughly satisfactory article can be written, but it is rather remarkable that even so experienced and accomplished a surgeon as Shepherd can prepare a monograph open to so few hypercritical objections. He attempts no differential diagnosis of the various forms of goitre, and is satisfied to approve Bloodgood's advice to

remove every asymmetrical enlargement of the thyroid in patients over thirty years of age. He urges the surgeon never to remove the whole thyroid, and always to leave the parathyroids; but in another place (p. 400) he states that he has extirpated completely over a dozen thyroids, and has taken no care to preserve the parathyroids, yet he has never seen a case of tetany except in a patient on whom repeated operations were performed for carcinoma; and at page 392 (footnote) he says that he "is of opinion that, as isolated portions of thyroid never slough when left behind, the parathyroids also get sufficient nourishment from capillaries;" so that he rather minimizes the value of Mayo's and Halsted's recommendation to tie the terminal branches rather than the main trunk of the inferior thyroid artery.

Carson's excellent article on the surgery of the thorax and spine, covering 100 pages, is worthy of careful attention. In speaking of excision of the clavicle for malignant tumors, he questions whether the operation is justifiable in view of the high immediate mortality and the doubtful ultimate outcome. In complete severance of the spinal cord, he advocates its suture, "if only for the purpose of giving the patient a chance to receive that degree of repair which appears to have been granted to others." This is an exceedingly canny statement. He advocates laminectomy for fracture-dislocations of the spine, only after subsidence of shock, in cases in which it is clear that the cord is not irreparably injured. He is very conservative in regard to spina bifida, advising operation only after the age of five years.

Mudd compresses into less than 60 pages one of the most satisfactory accounts of surgery of the female breast which has lately been published. He makes no mention of frozen sections, but speaks encouragingly of the hemolytic test of Crile. He urges beginning the operation by dissection of the axilla. Graves' article on the female external genitalia contains nothing calling for special comment save the number of operative procedures invented by the author. Nearly one-fifth of Balch's article on the male genitals is devoted to anatomy and embryology, though nothing is presented which is not contained in the usual text-books of anatomy. No notice is taken of the teaching of Corner that the imperfectly descended testicle is only very rarely spermatogenetic, and if so, only from twenty to twenty-three years of age; but as the internal secretion is usually quite normal, we fail to understand Balch's advice never to return both testes to the abdomen in children, and cannot approve his preference for orchidectomy when orchidopexy in children is impossible. While excision of such testicles may be quite proper in adults, since the external secretion, if it ever existed, has ceased, and the internal secretion is no longer necessary for physical development; yet surely in children under the age of puberty the testicles should be retained, either inside or outside the abdomen, until male characteristics are acquired.

Bloodgood's article on the surgery of the jaws is illustrated by several excellent colored plates, the delay in the execution of which necessitated placing the text at the end of the volume. He recurs again and again to the idea that no operations, be they ever so extensive, are sufficient for the highly malignant forms of sarcoma, since distant metastases occur very early; and that local, though thorough, extirpations are quite sufficient for the less malignant sarcomatous tumors. The differential diagnosis is to be made by exploratory incision. In the case of carcinoma, on the other hand, distant metastases are almost unknown, and a wide removal of the diseased area and the regionally related lymph nodes, *en bloc*, is the proper surgical treatment.

A. P. C. A.

A TEXT-BOOK OF SURGERY FOR STUDENTS AND PRACTITIONERS. By GEORGE EMERSON BREWER, A.M., M.D., Professor of Clinical Surgery in the College of Physicians and Surgeons, Columbia University, New York. Second edition; pp. 915; 429 illustrations. New York and Philadelphia: Lea & Febiger, 1909.

It is scarcely more difficult for a camel to pass through the eye of a needle than it is for an author to compress the teachings of modern surgery into the limits of a volume moderate in size. In 1903, when Dr. Brewer published the first edition of his excellent text-book (700 pages), he appears to have adopted very radical methods to keep within the limits set for him by the publishers; the latter portions of that volume were therefore less satisfactory than those first written. In the second edition, however, the various parts are well-balanced, most notable additions having been made in the chapters on the head (increased from 43 to 64 pages), the thorax (from 7 to 21 pages), the abdomen (from 68 to 92 pages), the kidneys (from 28 to 44 pages), and the bladder (from 29 to 41 pages). The number of illustrations has also been increased nearly 50 per cent., and several colored reproductions of photographs made by the Lumière process have been added. While the latter are in some ways an interesting addition, it is questionable whether less lurid illustrations might not teach the student quite as much surgery.

While there is little to criticise, and much to praise, in this text-book of Dr. Brewer's, we believe that a little more systematic arrangement of his subject matter would make surgery easier for the student to learn (and this is the main object of any text-book); and that had the principles of surgery been treated a little more fully, space would have been economized and the teaching value of the book increased. The teaching of Dr. Brewer is, above all, sane and safe; he does not run after new gods because they are new, nor does he abandon the old for fear of being thought old-fashioned. He proves all things and holds fast to that which is good.

A. P. C. A.

A HANDBOOK OF THE DISEASES OF THE NOSE AND THROAT. BY EUGENE S. YONGE, M.D., Physician to the Manchester Hospital for Consumption and Diseases of the Throat, England. Pp. 407; illustrated. Edinburgh and London: Wm. Green & Sons, 1909.

THIS is an excellent handbook for the instruction and guidance of the commencing specialist, and an admirable handbook, too, for the more experienced one. Clear, concise, accurate, conservative, and resourceful, it commends itself to the reviewer as one of the very best that it has been his fortune to possess. Without any prominent use of the first person singular, it indicates close individual knowledge of the subjects of which it treats, expressed in language so plain as to prevent misconceptions.

The subject matters have been arranged in four sections: Diseases of the nose, the accessory sinuses, and the nasopharynx (why not rhinopharynx?); diseases of the pharynx; diseases of the larynx and morbid conditions of the upper respiratory tract which may occur in the course of chronic or acute infective diseases, and in connection with gout, rheumatism, and certain affections of the skin. This is followed by a modest appendix of formulæ which have been recommended in the text for cleansing or for therapeutic purposes. A sufficiently copious index concludes the volume. Discussion of the first three sections begins with the anatomy and physiology of the structures under consideration, and is followed by a description of the methods of examination. Then anomalies and malformations are recorded, and a systematic study presented of the inflammatory and other diseases and their treatment. The fourth section deals with tuberculosis, lupus, syphilis, leprosy, rhinoscleroma, glanders, acute specific fevers, rheumatism and gout, and cutaneous diseases having analogues in the throat.

The text book is illustrated by fifty-seven plates, many of them beautifully colored to the natural tints, and nothing overdone. Some of the plates contain two or more illustrations. There is an entire absence of any leaning toward instrumentomania, for comparatively few instruments are figured; and of those recommended a large proportion are devices of the earlier specialists.

In describing the anatomy of the structures, allusion is made to its utilization in the differential diagnosis of diseases, and attention is drawn to its significance both in favoring and in hampering surgical interventions. In the latter connection precautionary methods are indicated to prevent untoward results, and these are repronounced in detailing the technique of various operative procedures. The unnecessary or inconsiderate sacrifice of organs or of parts of organs, as, for example, extirpation of the tonsils, and partial or total resection of the turbinate bodies, is deprecated when not absolutely requisite; and while too early recourse to radical operations is disapproved, as in obscure accessory sinus

disease, the mistake of too long continued tentative measures before final resort to radical procedures is deemed equally reprehensible.

In certain surgical interventions usually requiring a minor operation preliminary to the main procedure, intervals of from several days to a fortnight or longer are frequently advised in classes of cases in which other operators allow only much shorter intervals or even none at all.

J. S. C.

A MANUAL OF DISEASES OF THE EAR, INCLUDING THOSE OF THE NOSE AND THROAT IN RELATION TO THE EAR. By THOMAS BARR, M.D., Lecturer on Diseases of the Ear in the Glasgow University, and J. STODDART BARR, M.B., Ch.B., Assistant to the Lecturer on Diseases of the Ear in the Glasgow University, Scotland. Fourth edition; pp. 477; 3 colored plates and 215 illustrations. Glasgow: James Maclehose & Sons, 1909.

IN its present form this manual is one of the best text-books which not only students and general practitioners, but both prospective and practising specialists can consult in studying the pathology and treatment of diseases of the ear, and of such maladies of adjacent structures as are provocative of diseases of the ear. Besides 215 illustrations of anatomy, pathology, instruments for treatment and methods of utilizing those instruments, there are three plates similar to those of Politzer, exhibiting in closely approximative tints the color and general appearance of forty-five representations of the membrana tympani as viewed through the illuminated aural speculum. The textual illustrations, anatomical and pathological, are excellent, with two exceptions where excellence should have predominated; both are pictures of rhinoscopic images, the perspective of which gives a poor and misleading idea of what is really to be seen on inspection by posterior rhinoscopy. We indulge the hope that in subsequent editions these may be changed for pictures in better accord with the good ones.

After an introductory note, six chapters follow on methods of examination, symptomatology, etiology, methods of treatment, operative treatment, and on diseases of the nose and throat in relation to the ear; and fifteen further chapters on the special structures of the ear and the individual diseases in detail, which, with an appendix on otalgia and on nervous and vascular supply of the ear, complete the professional text. Several additional pages record a series of 135 formulæ for the topical and constitutional remedies recommended in the body of the work. Three more pages are devoted to bibliographical references. A very satisfactory general index of 21 pages concludes the volume.

Practically, the complete range of study in connection with dis-

eases of the ear is presented in clear language, without verbosity, in accord with the prevalent views of the best authorities. Even the Bier treatment is alluded to, and while insufficient experience for opinion as to its merits is expressed, the writers add that personally they have gained much relief from all the distressing symptoms of a cold in the head by wearing during the night a broad elastic band lightly stretched around the neck. The instructions as to operative procedures are sufficiently detailed to guide the operator and prepare him for contingencies and sequelæ.

We should like to find in an English text-book some reference to the method of catheterization of the Eustachian tube through the mouth with specially constructed tubes, as published by Ephraim Cutter in this JOURNAL for April, 1872, and which the writer of this review has practised with great satisfaction since that time, guiding the tip of the catheter into the orifice under supervision of the image in the rhinoscopic mirror. It has been commended, too, by Menier, of Paris, Oppolzer, of Vienna; Stanislaus von Stein, of Moscow, and other Europeans, but is practically unknown or unappreciated in Great Britain and in America.

J. S. C.

Soured Milk and Pure Cultures of Lactic Acid Bacilli, in the Treatment of Disease. By GEORGE HERSCHELL M.D. (Lond.), F.R.S.M., Late Senior Physician to the Kensington General Hospital and to the National Hospital for Diseases of the Heart. Second edition; pp. 72; 8 illustrations. London: Henry J. Glaiser, Chicago Medical Book Co., 1909.

To those who have heralded the lactic acid bacillus as a panacea and have been led to administer it indiscriminately, Herschell's essay on this subject is heartily recommended. Although evidently himself an enthusiast, he has had the wisdom to emphasize with equal force the dangers and limitations as well as the advantages of soured milk and cultures of lactic acid bacilli as therapeutic agents. The first of the three chapters comprising this little book is a summary of recent advances in the diagnosis of intestinal auto-intoxication. Here he points out the futility of making the tempting diagnosis of auto-intoxication without first proving its existence by appropriate tests for both urine and feces. The second chapter, on the methods of using lactic acid ferments in practice, should prove a disquieting revelation to many who, with little knowledge of the chemistry and bacteriology of milk, have been eager to employ any of the numerous recently exploited commercial lactic acid ferments. Herschell regards as dangerous the use of commercial soured milk and liquid cultures of the Bulgarian bacillus. Dried cultures,

although admittedly the safest and most convenient of the commercial forms of the ferment, he has found for the most part unreliable. He is positive in his opinion that the surest and safest means of introducing the lactic acid bacilli into the intestines is to use fresh cultures of the Bulgarian bacillus, properly prepared in a laboratory, and less than a week old. The diseased conditions in which lactic acid ferments may at times be of value are enumerated in the concluding chapter. The author makes the point that hyperchlorhydria is an absolute contra-indication to all lactic acid therapy. The book is a timely review of a subject, which is attracting much popular as well as scientific interest and concerning which there is much misconception.

G. M. P.

LA CURE RADICALE DE LA HERNIE INGUINAL. By DR. LUCAS-CHAMPIONNIERE, Honorary Surgeon to the Hôtel-Dieu. Pp. 186; 53 illustrations. G. Steinheil, Paris, 1909.

THIS volume is the first of a series of monographs which Dr. Lucas-Championnière is preparing on the radical cure of the different varieties of hernia. Based upon the clinical teaching, which the author gave for many years at the Hôtel-Dieu, it is written from the standpoint of the individual surgeon, and plainly sets forth his views and describes in detail the technique of his operation. After a general review of the anatomy of hernia, the problem of radical cure, a criticism of other methods of operating, and an analysis of the results which he himself has obtained, the author proceeds to a consideration of his own method. He maintains that suppression of the hernial contents, ligation of the sac *above* the internal abdominal ring, and overlapping the aponeurosis of the external oblique muscle are essential to the attainment of a successful permanent result. Overlapping of the aponeurosis is stated to be the most distinctive and original element of the operation.

While it will be evident to all who may study this work carefully that it is replete with sound surgical judgment, and that the author's results have been good—about 0.3 per cent. mortality and, as far as he has been able to determine, 4.1 per cent. of recurrences in nearly eleven hundred operations, including those which were done when radical cure procedures were in their infancy—it is doubtful if many modern surgeons will agree with the author as to the advisability of certain practices which he considers indispensable to success. Thus, we believe that few can be found who will pull the omentum out of the abdomen and resect it when it fails to present itself in the hernial sac, or divide the round ligament, or drain the superficial wound. It is likewise doubtful whether many will share his firm and long abiding faith in the power of carbolic acid solution to render the

field of operation "absolutely aseptic," or concur in his opinion that there is great danger of the spermatic cord being injured when it is transplanted according to Bassini's method. These criticisms in no wise detract from the general value of the work. In its entirety we esteem it highly, and can cordially recommend its perusal to all who are interested in the subject of which it treats. C. W. B.

DIE DIREKTE LARYNGOSKOPIE, BRONCHOSKOPIE, UND OESOPHAGOSKOPIE. VON DR. MED ET PHIL. W. BRÜNINGS, Privatdozent an der Universität Freiburg i. Br. Pp. 406; 112 illustrations. Wiesbaden: J. F. Bergmann, 1910.

THIS work constitutes an important contribution to the literature of the subject of the direct examination of the upper air passages and the œsophagus. Brünings uses an apparatus of his own device, the light, as in most of the German instruments, being cast from the proximal extremity of the tube through its length. In the United States practically all laryngologists use the Jackson light, which is placed on a carrier and run through the side of the tube, almost directly to the spot which it is desired to illuminate. Aside from this difference, the book in its general description, as regards technique and the various cases in which the method is of value, is in agreement with the views of Jackson and others of the American school. Brünings's illustrations are particularly good. He has some excellent x-ray photographs, and other cuts, which are of great value as illustrating the various positions which the tubes assume in bronchoscopy and œsophagoscopy. F. R. P.

THE SEXUAL DISABILITIES OF MAN AND THEIR TREATMENT. BY ARTHUR COOPER, Consulting Surgeon to the Westminster General Dispensary, London. Pp. 184. New York: Paul B. Hoeber, 1909.

IN this small volume Mr. Cooper discusses, in a sane and dignified, although exceedingly brief, manner, the sexual disabilities of man, dividing the discussion into two parts—sterility and impotence. In the first part he treats of the semen, quantitative and qualitative changes in the semen, changes in the zoöspersms, and the treatment of sterility; and in the second part, he discusses sexual physiology, primary and secondary impotence, and the local and general treatment of the condition. The booklet is to be recommended to those desiring a brief exposition of the subject, founded upon large personal experience. A. K.

PROGRESS OF MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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The Pupillary Symptoms in Thoracic Aneurysm.—In a clinical lecture OSLER (*Practitioner*, 1910, lxxxiv, 417) showed a patient with a large aneurysm of the arch of the aorta, associated with unequal pupils and absent knee-jerks. In his discussion of the pupillary symptoms of thoracic aneurysm he recognized three groups of cases: In the first of these there is involvement of the sympathetic nerve by direct pressure of the aneurysmal sac. This is, however, rarely met with at postmortem examinations. Clinically, moreover, in most cases of aneurysm, pupillary features are present without other indications of involvement of the sympathetic system—such as unilateral flushing and sweating of the face, ptosis, and retraction of the eyeball. Dilatation of the pupil on one side may, however, be the sole indication of pressure on the sympathetic, and is sometimes met with in pneumonia, apical tuberculosis, and chronic pleurisy. Myosis with profuse sweating and occasional slight ptosis is more common than mydriasis with unilateral flushing, increased heat, and sweating. In the second class of cases the inequality of the pupils depends on the vascular condition of the iris. Wall and Walker believed that the most common cause of anisocoria is unequal blood pressure in the ophthalmic arteries. The vessels of the iris are spiral or zig-zag, and a rise of blood pressure tends to lengthen them and leads to a narrowing of the pupil, while a fall in pressure causes shortening of the vessels and enlargement of the pupil. The variations of pressure in the vessels of the iris do not correspond, however, to the variations in the radials, as the radial pulse may be larger on the side on which

the pupil is smaller. In the third group is found the association of pupillary symptoms, aneurysm, and tabes—the Babinski syndrome—all a part of the syphilitic infection. In these cases the irregularity of the pupils or the myosis is not due to compression by the sac, but is the ocular manifestation of a tabetic or taboparetic state. The Babinski syndrome means merely a condition in which aneurysm is present along with tabetic features—the Argyll-Robertson pupil or unequal pupils, with absent knee-jerks or lightning pains.

The Quantitative Estimation of Albumin in the Urine.—Although the Esbach method is in wide use as the simplest means of quantitative estimation of albumin in the urine, its sources of error and inaccuracies are such as to make it of comparatively little value. In order that any degree of accuracy be obtained the urine must be diluted to a specific gravity of 1006 to 1008, and so that the albumin will read 4 grams or less to the liter, and the temperature should be at or near 15° C. The readings are frequently upset by the fact that the precipitate does not settle, or does not settle evenly, or by the precipitate forming immediately on mixing and thus interfering with the reading of the meniscus. As an improvement on the Esbach method, Tsuchiya has suggested the use of a solution of phosphotungstic acid, as follows: Phosphotungstic acid, 1.59 grams; hydrochloric acid (concentrated), 5 c.c.; ethyl alcohol, q. s. ad 100 c.c. This solution is substituted for the picric-citric acid solution and is used in Esbach tubes. MATTICE (*Arch. Int. Med.*, 1910, v, 313) has made a comparative study of the value of this method, and of its modification by Goodman and Stern and the Esbach test, controlling his results by means of the gravimetric and Kjeldahl methods. The method of Goodman and Stern proved to be very inaccurate. Tsuchiya's method, however, gave extremely good results. The precipitate invariably settled more evenly and read closer to the weighings than it did with the Esbach. In a series of cases, readings made at room temperature showed that the average difference in albumin content as compared with the gravimetric and Kjeldahl method was 1.736 with the Esbach and only 0.297 with the Tsuchiya method. The phosphotungstic acid solution is lighter than water, and the urine need not be diluted. The presence of sugar in the urine is of little importance with the phosphotungstic acid. A slight precipitate with readings of 0.5 gram per liter and above in cases of nephritis in which the urine was examined daily showed very close relationship between the Kjeldahl and phosphotungstic acid methods, while the Esbach method proved quite unreliable.

The Relationship Between the Wassermann Reaction and Mercurial Treatment.—KIRÓLYFI (*Wien. klin. Woch.*, 1910, xxiii, 162) refers to the disappearance of a positive Wassermann reaction frequently noted during vigorous antiluetic treatment with mercury. Since it is not known whether this effect is due to the presence of mercury alone or to its action on one of the bodies concerned in the Wassermann reaction, the author has investigated the action of corrosive sublimate on the test in vitro and in vivo. The test-tube experiments confirmed the facts already noted by Detre and Sellei to the effect that relatively

strong bichloride solutions cause no hemolysis of washed red blood cells, the corpuscles being fixed and sinking to the bottom of the tube. Weaker solutions cause laking of the red cells. The author found that laking occurred with solutions varying in strength between 0.003 to 0.004 per cent. and 0.04 to 0.06 per cent. When bichloride was added to the usual components of the Wassermann reaction, so that its resulting strength would fall within these limits, hemolysis took place, that is, a test which otherwise would have been positive became negative. It seemed probable, therefore, that the disappearance of a positive test during active mercurial therapy was due simply to the mercury in the patient's blood serum. In order to determine this point, luetic patients were studied before and during mercurial treatment. If the negative reaction during treatment is due to the mercury *per se* in the patient's serum, then the inactivated serum should cause hemolysis without the addition of hemolytic serum. As a matter of fact, hemolysis did occur. The interpretation of the result is complicated, however, by the fact that normal human serum contains amboceptors for sheep corpuscles. Therefore, it becomes necessary to remove the complement entirely from the experiment. When this is done, there is no hemolysis, showing that whatever mercury is present is quite inactive so far as hemolysis is concerned. This result indicates, the author believes, that mercury has a specific action on the luetic bodies in the patient's serum.

Experimental Anterior Poliomyelitis.—LEVADITI AND LANDSTEINER (*Compt.-rend. Soc. de biol.*, 1910, lxxiii, 417) have continued their studies on poliomyelitis in monkeys by investigating the method of entrance of the virus into the system. The nasal mucous membrane of monkeys in captivity shows an inflammatory process, but this is most marked in infected animals—a fact which points to the possibility of the disease being spread from the nasal passage. To determine whether the nose might be the portal of entrance, a few drops of virus were injected into the nasal mucous membrane of a monkey. Ten days later the animal became paralyzed and died. To find out the path of the infection the two olfactory bulbs of this monkey were triturated with saline solutions and the mixture injected into another monkey. Six days afterward the second animal died. The organism thus probably enters the brain by following the branches of the olfactory nerve. With a view to finding some means of preventing infection by the nasal passages, virulent emulsions of virus were mixed with antiseptics—methylated oil, 1 per cent., and a powder of menthol, salol, and boric acid. Two hours later the mixtures were injected into the spinal cords of monkeys. These monkeys showed only slight, temporary disturbances, while the control animal, injected with the virus alone, became paralyzed on the fourth day and died.

The Results of Cutting the Tawara Bundles.—EPPINGER and ROTHBERGER (*Ztschr. f. klin. Med.*, 1910, lxx, 1) have made a study of the effects of severing the Tawara bundle in the living dog's heart. They find that the cutting of one of the Tawara bundles leads to a visible alteration in the contraction of the heart; the two chambers of the heart no longer beat synchronously, but alternate. Auscultation

frequently gives a well-defined gallop rhythm. The most noticeable alteration is the change in the swing of the galvanometer needle (electrocardiograph). Severing the bundle does not necessarily lead to deleterious effects on the circulation. Provided there has not been much loss of blood, the heart beats with undiminished vigor for some time and the blood pressure is well maintained. The authors were not always successful in cutting the bundle, but in the cases in which the electrocardiogram showed no change, serial sections of the heart proved that the Tawara bundle had not been severed, while the positive cases always showed a lesion of the bundle. The authors have reproduced numerous electrocardiograms, which they discuss at considerable length. They show that the electrocardiogram assumes the form of right-sided extrasystoles when the left Tawara bundle is cut, and vice versa. This is explained by the fact that the right ventricle receives its normal stimulus from the auricle, whereas that to the left ventricle is interrupted by the cut in the Tawara bundle and only reaches it *via* the right ventricle. Furthermore, the result of bilateral cutting of the Tawara bundle brings proof of the physiological fact that the conduction of the stimulus to the ventricles is conveyed exclusively by the Tawara bundles. Again, the negative results, where the cut missed the Tawara bundle, show that deep cuts elsewhere in the ventricle do not affect its contraction. The fact that automatism becomes established after cutting the Tawara bundles, just as it does after severing the bundle of His, indicates that the site of automatism may not be situated exclusively in the Tawara nuclei.

Chronic Heart Block in the Dog.—ERLANGER AND BLACKMAN (*Heart*, 1910, i, 177) report seven instances in which chronic heart block was produced in dogs by injuring the auriculoventricular bundle. Of five of these, all, possibly with one exception, had complete and permanent heart block lasting from six to three hundred and forty-three days. One animal had a relatively complete block from which it recovered in twenty-six days, and one had a slight grade of block which disappeared within forty-eight hours. The average ventricular rate was about 25, while that of the auricles was 129. The ratio of auricular to ventricular rate is thus just about the same as is found in heart block in man. The ventricular rate increased if the animal was nervous, after muscular exercise, but more especially during etherization. Various types of cardiac irregularity were met with. Periodic irregularities, variability of the ventricular rate, and ventricular extrasystoles were rare. More frequent were the periodic irregularities. In association with Cheyne-Stokes respiration, slowing of the ventricular rate occurred more or less synchronously with acceleration of the auricular and respiratory rates. Another type of arrhythmia consisted of periodic, although somewhat irregular, acceleration of the ventricles. The cause of this "group beating" of the ventricles is obscure, but after each series of rapid beats there occurred a stoppage of the ventricles, associated with which there might be vertigo and syncopal attacks similar to those seen in Adams-Stokes disease in man. In comparison to the body weight the heart was hypertrophied to as much as 100 per cent. In one instance the effect of stimulation of the vagus was studied, and it was found that a weak stimulus, but one sufficing

practically to stop the auricles was almost without action on the ventricles, while the strongest stimulation only reduced the rate of the ventricles slightly. Stimulation of the accelerator nerve caused a greater proportional acceleration of the ventricles than of the auricles. In another case the injection of iodine solution into the region of the bundle caused at first a complete block, which later gave way to partial or, at times, a relatively complete block, and finally, after twenty-six days, resulted in a return to a normal conduction. Recovery was apparently due to decompression of the bundle through the removal of the iodine and of the inflammatory exudate. In no case was there any evidence of regeneration on the part of the conducting structures of the auriculoventricular bundle.

The Specific Meiostragmine Reaction.—ASCOLI (*Münch. med. Woch.*, 1910, lvii, 62) has discovered a new and, as he believes, specific immunity reaction which he designates the meiostragmine reaction (*μείων*, small, and *στράω*, to drop). The reaction depends upon alteration of the surface tension of an immune serum plus its specific antigen when tested before and after incubation in the thermostat. The apparatus used is the stalagmometer of Traube, by which the number of drops in a given quantity of fluid may be accurately determined. It was found that corrections for temperature need not be made, provided all determinations are made at room temperature. As a concrete example of the specificity of the meiostragmine reaction, Ascoli presents protocols of experiments performed with sera of typhoid fever patients which agglutinated typhoid bacilli in dilutions varying between 1 to 80 and 1 to 360. The serum was used in a dilution of 1 to 10. As antigen, the author employed the alcoholic extract of typhoid bacilli prepared according to the method of NEISSER and SHIGA (*Deutsch. med. Woch.*, 1905). The antigen was used in dilutions of 1 to 1000, 1 to 10,000, 1 to 100,000, and 1 to 1,000,000. As a diluent for both serum and antigen, 0.85 per cent. NaCl was used. To 9 e.c. of the diluted serum 1 e.c. of the diluted antigen is added, and the number of drops is immediately determined. The mixture is now placed in the incubator at 37° C. for two hours, removed, and allowed to cool to room temperature. A second determination of the drops is now made. When the antigen was employed in dilutions of 1 to 1000 to 1 to 100,000, the number of drops was always found to be increased by two to three after incubation, this result constituting a positive reaction. Normal sera, used as controls, when united with typhoid antigen, always gave negative results, that is there was no decrease in the size of the drops after remaining in the incubator two hours. Similarly, the substitution of colon bacillus extract as antigen with typhoid serum caused no lowering of the surface tension. The reaction probably depends at least, in part, on substances soluble in alcohol (lipoids), since the alcoholic precipitate, when used as antigen, gave negative results. The reaction shows, the author says, the importance of a more careful study of physico-chemical processes in connection with immunity reactions.

The Meiostragmine Reaction in Malignant Tumors.—ASCOLI and IZAR (*Münch. med. Woch.*, 1910, lvii, 403) report a series of observations

made on the blood of patients suffering with malignant tumors, with a view to determining the possibility of applying the meiostagnine reaction in such conditions as a means of diagnosis. As controls, they used blood from patients suffering with various other diseases. Preliminary to their observations on human sera, they made a study of normal and sarcomatous rats. The preparation of the sarcomatous antigen is given in detail. Of 9 sarcomatous rats tested, all gave a positive meiostagnine reaction, while 8 normal rats reacted negatively. Using the sarcomatous antigen of the rat, they tested sera from patients and found a negative reaction in 28 cases which were non-malignant (including 2 lipomas), while 29 of 31 malignant tumors, among them 3 sarcomas, gave a positive reaction. (Most of the diagnoses were confirmed microscopically). Since then, the authors have prepared antigen from 6 different human carcinomas and find, to their surprise, that it must be used in very much more dilute solution (1 to 10,000) than was found to be advantageous with the rat antigen. In a footnote the authors state that their material now includes 62 cases of malignant disease, of whom 58 gave a positive meiostagnine reaction. In 48 non-malignant cases a positive reaction has not been encountered. Of the negative (non-malignant) cases, 2 leukemias were included. As yet, they have not had the opportunity of examining the blood of patients suffering with fibromas and myxomas.

A Specific Property of Luetic Sera.—IZAR (*Münch. med. Woch.*, 1910, lvii, 182), working in Aseoli's laboratory, has applied the meiostagnin reaction, lately described by the latter, to the study of luetic sera. In all, his observations included twelve different sera, eleven of which yielded a positive Wassermann test. As antigen, the author made use of the alcoholic extract of a spleen obtained from a syphilitic foetus. The organ was dried and rubbed up; 0.5 gram of the powder was shaken in 50 c.c. of alcohol, placed in the incubator two hours, filtered, and the filtrate condensed to 10 c.c. This stock solution of antigen was then diluted as necessary with 0.85 per cent. NaCl solution. For purposes of control, the luetic sera were united with various other antigens, namely, alcoholic extracts of organs showing tuberculosis, echinococcus, carcinoma, and sarcoma, and watery extract of typhoid. For further control, three sera from patients suffering with leprosy (two of which gave positive Wassermann reactions) were tested with all antigens. Dilutions of the luetic sera varied from 1 to 20 to 1 to 100 in 0.85 per cent. NaCl. For the antigen, the author found a dilution of 1 to 100 in 0.85 per cent. NaCl to be the best. To 9 c.c. of the diluted serum, 1 c.c. of diluted antigen was always added. The author's figures show that in all twelve sera the addition of syphilitic antigen caused an increase of two to five drops, whereas controls never showed an increase of more than one drop, usually only a fraction of a drop. When other antigens were used with the luetic sera, the increase in the number of drops after two hours in the incubator never exceeded one, showing apparently that the reaction is a specific one. The sera from the three patients with leprosy, as well as sera obtained from patients suffering with various other diseases, always reacted negatively. Especially noteworthy was the negative reaction in the case of the two leprosy sera which gave a positive Wassermann reaction.

These sera had been sent to the author simply as sera showing a positive Wassermann test. It was only after the negative meiostagmine test had been obtained that the author learned that the sera were not luetic in origin. Although the results obtained thus far are very encouraging, the author feels that the value of the method as a diagnostic aid is by no means proved with the small material he reports.

SURGERY.

UNDER THE CHARGE OF

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The Indications and Practical Value of Pyelotomy for the Removal of Calculi in the Renal Pelvis, Based Upon a Study of 103 Cases.—PERINEAU (*Ann. d. m. d. org. gén.-urin.*, 1910, 1, 493) considers that pyelotomy is an ideal operation for the radical cure of calculi of the pelvis and calices. It is scarcely more difficult than nephrotomy, which compels the delivery of the kidney. It permits a careful and complete exploration of the pelvis and calices by direct palpation. It avoids damage to the renal parenchyma, since there may be bilateral nephritis, especially marked in old cases. It avoids the possibility of primary or secondary hemorrhage, which has caused death in some cases, and permits catheterism of the ureter to determine its freedom from obstruction, which is essential to an uncomplicated cure. In all cases in which the ureter was clear healing occurred without a fistula. If in uncovering the kidney there is found an accentuated perinephritis preventing or rendering difficult the exposure of the ureter, the operation of pyelotomy should be abandoned. The lacerations and hemorrhage would make the operation a blind one and hazardous. The contra-indication is more marked in pyonephrosis. To expose the calculi and provide for drainage, it is much more rational to make a wide opening in the kidney, which may be the seat of a purulent collection. On the other hand, in cases of slight calculous pyelitis and perinephritis, pyelotomy is not contra-indicated. Then a more careful suture is required, in a double or triple layer. A renal calculus can be removed only by section of the parenchyma where it is enclosed. An attempt should never be made to remove a calculus requiring a large wound of the pelvis, and especially an incision invading the ureter. Every large stone invading the whole renal reservoir, which will be irregular and coral-shaped, ought to be removed by nephrotomy. Multiple, small calculi, according to the experiences of Delbet and Mocquot, should

be removed by a pelvic incision. Practice alone, however, can indicate the best method, and it seems to indicate clearly that nephrotomy is more effective in these cases. In those in which the clinical symptoms point to stone, and palpation of the pelvis does not detect it, Perineau does not counsel an exploratory nephrotomy. The reported cases in which this has been done do not show that nephrotomy has disclosed a stone when palpation has failed. In an anuric patient two accidents may supervene. Uremia may develop even in the beginning, and may compel an immediate and rapid operation. In such a case it is preferable to do a nephrostomy to save the patient's life. If there is a quiescent period, catheterism of the kidney to be operated on should be done. It may remove an obstruction of the ureter or locate the seat of the calculus. The skiagraph may also locate it. If catheterism does not reestablish the function of the kidney, operation should be done at once and the pelvis exposed. The stone is found here most frequently, and then should be removed by a pyelotomy. The ureter can be probed for a second calculus, which according to Legueu, is nearly always impossible in a nephrotomy.

Treatment of Fractures by Parathyroid Medication.—MOREL (*Archiv. gén. d. chir.*, 1910, vi, 231), as the result of experiments upon animals, believes that the parathyroids play an indisputable role in osteogenesis; that their action is equally distinct in the growth of healthy bone, and the cicatrization of fractured bone; that their action, which is certain on the young organism, seems to be nil upon adults; that all or part of the role in osteogenesis attributed to the thyroid should be assigned to the parathyroids; and that it would be important to make a trial in man of the accelerating action of parathyroid medication in the consolidation of fractures.

Traumatic Lesions of the Semilunar Cartilages of the Knee.—GORSE (*Archiv. gén. d. chir.*, 1910, vi, 244), in accounting for the slight attention given to these injuries in France as compared to England, says that it is partly due to the greater indulgence in sports in England, and to a less systematic examination for the lesion in France, where many of the cases of hydrarthrosis rebellious to treatment, and diagnosed as tuberculous, are probably due to this cause. He reports a case of subluxation of the external semilunar cartilage with subluxation posteriorly of the tibia. He discusses, however, the more common variety, the dislocation of the semilunar cartilages without concomitant lesions. It is much more frequent in the left than the right knee, and involves the internal cartilage more often than the external. Dambrin, from cadaver studies, determined that the internal cartilage is more poorly fixed, and is thinner than the external, the internal being 3 mm. in thickness, the external 7 mm. Bennett and Jones have classified the possible lesions in essentially the same way. The peripheral attachments of the cartilage may be torn, the anterior and posterior remaining intact. The anterior cornu may be detached, the free end either shrinking up in the interior of the articulation or rolling up on the articulating surface of the femur in the parapatellar groove. The posterior cornu may be detached, but this is so rare as to render it negligible. Transverse fissures of the cartilage may occur, the frag-

ments being drawn inward, and the tibioartilaginous ligaments and capsule not maintaining the cartilage in place. Longitudinal fissures in the middle two-thirds of the cartilage may take place; the internal fragment, remaining fixed at its two points of attachment, deviates inward. Finally, true luxations may occur, characterized by tearing away of the cartilage either at its periphery or the cornua, with shrinking toward the glenoid surfaces. When the accident occurs there is a sudden fixation of the leg in semiflexion, with a very severe pain and sometimes a distinct crackling sound. Soon there is an intra-articular effusion, usually moderate, and sometimes fugacious. At the inter-articular line, usually antero-internally, there is a prominence or depression, the latter being absolutely pathognomonic. There may be an associated subluxation of the tibia. A systematic examination should be made in each case. The treatment should be carried out as soon as the diagnosis is made, to prevent the development of a chronic joint inflammation. In recent cases reduction of the dislocated cartilage is the first indication. Forced flexion should be followed by sudden extension. A crackling and a return of the joint movements indicate that reduction has taken place. If this fails, it should be done under an anesthetic, and, if necessary, continuous extension should be employed afterward. Three operations have been practised—menisceopexy or fixation of the cartilage by suture, partial and total meniscectomy, or excision of the cartilage. Nearly all authors are partial to excision. Drainage should not be employed if the excision has been easy, but is indispensable if it has been tedious and laborious or whenever there is reason to distrust the asepsis. Dambrin, in 117 cases, did menisceopexy in 36, with 21 perfect results, 10 good results, 3 mediocre, and 1 bad. In 82 cases he did meniscectomy, with 53 perfect results, 26 good, 3 mediocre, and none bad.

The Functional Results Following Resection of the Elbow with the Interposition of Muscle Flaps by Helferich's Method.—REINER (*Deut. Ztsch. f. Chir.*, 1910, civ, 209) says that by the resection of the elbow-joint two objects are sought—to remove the focus of disease, and to give the patient a useful joint. In two years, twenty-eight resections of the elbow joint were performed. The indications were tuberculosis, ankylosis after fractures, irreducible dislocations, polyarthritis, gonorrhœal and suppurative arthritis. Recently the operations have been done almost exclusively under anesthesia induced through the veins. The Langenbeek resection was employed and the incision carried far enough upward to permit a sufficiently large muscle flap to be obtained. The humerus was made convex and the radius and ulna concave, according to Helferich, saving as much bone as possible. A large pedunculated flap was then taken from the radial side of the triceps including a part of the tendon. This was placed in the concave surface of the forearm bones and fixed by a few catgut sutures to the surrounding soft tissues and periosteum, so that a displacement of the flap could not occur, and the bone wounds were entirely covered. The wound was then closed completely by sutures and the arm dressed in complete extension. The dressing was first changed in eight days, and daily after that the joint was alternately placed at an acute and an obtuse angle. Energetic active and passive movements, massage, and hot

air treatment were carried out. In operations for old fractures and dislocations it is very important that all callus, detached fragments of bone and of capsule should be carefully removed, since they tend to produce new bone formation and renewed limitation of motion. The end results were observed in 23 cases; of 2 there was no report and 1 died of unknown cause. In 4 the results were absolutely bad. One of these was a case of recurring myositis ossificans, and should be excluded because the failure was not due to the operation or after treatment, but to the underlying condition. In 21, over 90 per cent. of normal movement was obtained, in 2 under 90 per cent., and in 2 under 30 per cent. Pain persisted in 4, in 19 full function was obtained, in 4 no function, in 1 a marked flail joint, and in 2 complete ankylosis. In 1 of the 4 in which the results were absolutely bad the arm was much atrophied and powerless. The cause was probably in the use of too large an interposed flap and insufficient removal of the disease. In another case the cause of trouble was a high-grade flail joint, and in the third the ankylosis was due to new bone formation. Permission for a second operation was refused. Primary healing is absolutely necessary for the best result, although in a large number good results were observed after healing by granulation, and in three cases even with necrosis of the muscle flap. The numerous modifications and similar operations show the great interest in the method. Interpositions of capsule, tendons, periosteum, fatty tissue, skin, cartilage, and various organic and inorganic foreign substances have been employed, but probably none have given so many and so good results as Helferich's method.

A Contribution to the Surgery of the Liver and Bile Passages.—JENCKEL (*Deut. Ztschr. f. Chir.*, 1910, clv, 1) studied 233 cases involving the biliary passages, of which, 230 were operated on. Of these, there were 7 cases of acute infectious cholecystitis, 100 of chronic recurrent cholecystitis, 22 of hydrops of the gall-bladder, 26 of empyema of the gall-bladder, 24 of calculous obstruction of the common duct, 10 of occlusion of the biliary passages. Of these, 211 were in females and 19 in males. This shows the usual predominance in the female sex, usual at least, in Europe, although among the Japanese, according to Mizokuchi, there were 40 men to 26 women. Of the 230 cases, 30 died, a mortality of 13 per cent.; 9 died from diffuse peritonitis, 6 from pneumonia, 1 from embolus, 4 from cholemia, 3 from cholangitis, 1 from hemorrhage due to erosion of the right epigastric artery from suppuration, and 1 from chloroform anesthesia. The following operations were performed for conditions complicating gallstones: Laparotomy for carcinoma, pancreatitis, etc., in 27 cases; incision for abscess of the abdominal wall in 4; gastro-enterostomy in 6; hepatopexy in 1; liver resection in 3; cecostomy in 1; and entero-anastomosis in 2.

Long-continued Primary Etherization.—Moskowitz (*Zentrbl. f. Chir.*, 1910, xxxvii, 193) says that Sudeck, Thiersch, and Nettel in isolated cases succeeded in prolonging primary anesthesia with ether combined with morphine injections, for as long as two hours. Moskowitz has

been employing the method for years in an increasing number of cases. It is not unusual to keep up the anesthesia for an hour to an hour and a half, and to perform with it such operations as excisions of the large intestine, of the stomach, and of the ovaries. The patients during the operation respond when aroused, answer to their names, and look around. The condition is not a narcosis, but is best compared to an alcoholic intoxication. Most patients can thus be intoxicated readily with varying quantities of ether, violent men and hysterical women not so easily. A few drops of chloroform may sometimes be necessary. Under its influence the character of the intoxication changes markedly and the patient remains quiet when the ether is renewed.

Methods of Treatment for Air and Fat Emboli.—VON LESSER (*Zentralbl. f. Chir.*, 1910, xxxvii, 213) calls attention to facts previously published concerning the effect of air in the heart. The heart valves and, especially, the tricuspid are competent in the presence of fluid. If air in large quantity instead of blood fills the heart cavities, the valves become insufficient, and the abnormal contents of the right heart will be pushed backward and forward like a cork between the pulmonary artery and caval veins. If the heart of an animal is exposed through the sternum without opening the pleuræ, and air is introduced into the heart through the jugular vein, the heart will be seen to contract in vain. Gradually, the coronary arteries become filled with air or bloody froth, and soon the contractions of the heart completely disappear. If, now, an indifferent fluid substance (0.5 per cent. saline solution) is injected through the muscle substance directly into the right ventricle, until gradually the fluid becomes greater in quantity than the air, then the heart contents will be gradually pushed onward and the valves again become competent. Soon the blood follows, the heart contractions become stronger, and the circulation is restored. Recent publications have shown that these facts may be employed in the saving of life. Schantz, for example, has recently reported good results in cases of fat emboli, from subcutaneous and intravenous infusions of saline solutions.

Continuous Syphonage of the Stomach in the After-treatment of Severe Cases of Peritonitis.—WESTERMAN (*Zentralbl. f. Chir.*, 1910, xxxvii, 356) says that one of the most important points in the treatment of peritonitis after operation, is to combat the auto-intoxication, which is the result of the interference with intestinal peristalsis. The intestinal contents soon become foul with the production of poisons which are absorbed. Gas formation is marked and irritants are formed which inflame the gastric and intestinal mucosa. In order to avoid this auto-intoxication, the stomach is frequently emptied by an œsophageal tube, but the result is brief and often the introduction of the tube causes great disturbance, so that preference is often given to the formation of an opening in the intestine. But this operation is a severe one in the usually exhausted patient, and unfortunately often does not accomplish the purpose for which it was performed. When it is effective, it is often a life-saving procedure. Usually the opening is made low in the small intestine, in order that the danger of inanition may be lessened and the inflammation of the skin from the irritating

intestinal secretions decreased. On one occasion, Westerman had occasion to make such an opening in the first portion of the jejunum. The patient was almost dead, was vomiting continually a black, stinking substance, and the attempts to empty the stomach by a tube had failed. The formation of the jejunostomy was followed by a cessation of the vomiting, the distended intestines emptied themselves, and the patient recovered. This experience led to the employment, in another case of severe peritonitis, of an œsophageal tube passed through the nose to the stomach and left in position for several days. The result was very encouraging. In twelve hours, 4 liters of intestinal fluid were evacuated from the stomach, and in addition a large quantity of gas. Two days later the stomach contents were only slightly colored with bile and the tube was removed. Since then the stomach tube has been employed in this way in 15 cases with good results. The tube should have a diameter of 0.5 cm., and should not be too thin, since the opening would then close too easily. Two lateral openings should be made in the lower end of the tube, to prevent closure of the tube by the mucous membrane of the stomach.

Volkman's Deformity of the Ankle as a Result of a Congenitally Faulty Position of the Fibula.—CHRYSOPTHIES (*Zntrbl. f. Chir.*, 1910, xxxvii, 434) says that all the text books of orthopedic surgery teach that this condition, described first by Volkmann, is a congenital luxation of the foot, due merely to a partial defect of the lower end of the fibula. He has seen two cases within a period of seven months, and is convinced that in his cases, at least, there was not the slightest defect in the fibula. The x-rays did not show a defect, and in the second case operation also failed to show it. He found that the deformity was the result of a displacement of the lower end of the fibula, posteriorly and internally. In the first case, a boy, aged four years, the deformity was observed soon after birth, and increased each year, although it did not hinder his running or jumping. The clinical picture was that of the Volkmann deformity, and the foot was in the equinus position with a tense tendo-Achilles. An incision was made behind the internal malleolus at an obtuse angle, the tendo-Achilles was divided at its insertion and sutured to the inner side of the calcaneus in order to place the foot in a varus position, a plaster of Paris bandage fixing it in the over-corrected position. After removal of this bandage the wearing of a supporting apparatus was necessary. The result was not altogether satisfactory. In the second case the external malleolus could be followed in the normal position of the tendo-Achilles. A vertical incision was made over the lower end of the external malleolus. As this was deepened instead of the Achilles tendon the peroneal tendons were found, and deeper the external malleolus. After freeing this bone from the surrounding soft tissues and the tibia, it was found to be of its normal size and form. A place was made for it in its normal position, to which it was forced after breaking the fibula, $1\frac{1}{2}$ fingers' breadth above the epiphysis, the lower fragment then being fixed in its new position with catgut. A plaster-of-Paris cast held it in place and three weeks after operation was removed, when the x-rays showed the malleolus in its new position. After the use of an orthopedic supporting apparatus for a short time, the patient could walk normally. Volkmann's de-

formity is shown, therefore, to be due, in some cases, at least, not to a defect in the lower end of the fibula, but to a faulty position of the bone. It is evident that the foot turns inward under the influence of the weight of the body. It is not intended here to deny that the defect which others have reported cannot exist. The purpose is to call attention to the findings in these two cases, and to ask that observations be made to determine which condition is the most frequent.

THERAPEUTICS.

UNDER THE CHARGE OF

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The Treatment of Tuberculosis with Large Doses of Tuberculin.—NEUMANN (*Deutsch. med. Woch.*, 1910, xxxvi, 209) thinks that children can take much higher doses of tuberculin than those ordinarily given. He considers that the local reaction at the site of injection offers the best guide for the treatment. In the event of a local reaction an increased dose must not be given until the reaction has subsided. He reports one case, a rachitic boy, aged four years, who improved markedly under tuberculin treatment. The initial dose in this case was 0.0001 gram. Injections were given at intervals of from one to six days until a dose of 0.5 gram was attained at the end of six months. Neumann advises great caution in using tuberculin treatment when there is any focus near the central nervous system.

The Tuberculin Treatment of Dispensary Patients.—HAWES AND FLOYD (*Boston Med. and Surg. Jour.*, 1910, clxii, 1) draw the following conclusions as a result of their work on this subject: (1) Out of 143 patients with various forms of tuberculosis treated with tuberculin during the past four years, 19 have died, 16 have shown no improvement, while 108 have been benefited to a greater or less degree. (2) In no instance have they been able to see that tuberculin has done the slightest harm; reactions have been rare and invariably of a very mild type. (3) In incipient pulmonary tuberculosis, especially in children, tuberculin is a factor in increasing body resistance and in maintaining this resistance so as to prevent relapses. In more advanced pulmonary disease tuberculin will often alleviate distressing symptoms, prolong life, and occasionally help to arrest the process. (4) In localized or "surgical" tuberculosis tuberculin has a marked beneficial effect. Its administration should always be combined with hygienic outdoor treatment, and in the vast majority of instances should be subservient to this. (5) Dispensary patients can be treated with tuberculin not only with perfect safety, but with benefit, providing there is a close personal coöperation between patients and physician.

The Results of the Combined Sanatorium and Tuberculin Treatment of Pulmonary Tuberculosis.—BANDELIER (*Beiträge z. klin. d. Tuberkulose*, 1910 xv, 1 to 180) gives a very exhaustive report of the combined tuberculin and sanatorium treatment of 500 cases of pulmonary tuberculosis. Only 18 of the 500 cases (3.6 per cent.) were not benefited and these were all in the third stage of the disease. In 17.2 per cent. of the total number the patients were apparently cured. He divides the cases that improved into two general classes—those who regained full earning capacity and those who regained sufficient earning capacity for the legal standard. The cases that regained full earning capacity comprised 90.4 per cent. of 83 first-stage cases, 80.7 per cent. of 286 second stage cases, and 32.8 per cent. of 131 cases of the third stage. The cases that attained the legal standard in their earning capacity were divided into 9.6 per cent. of the first stage cases, 19.3 per cent. of the second stage cases and 53.4 per cent. of the third stage cases. Thus, he denotes his results as positive in 100 per cent. of first and second stage cases and in 86.2 per cent. of third stage cases. The most striking results were shown in the 286 cases of the second stage. Bandelier believes that the conflicting results obtained by different observers with the tuberculin treatment may be explained by variations in the length of the tuberculin treatment. He thinks that such a treatment, to be effective, must be carried on for a considerable period of time. Bandelier's average period of treatment was from five to six months. He advises giving the tuberculin until the maximum dose is reached, and then injecting this maximum dose at constantly increasing intervals. He gives many details of the treatment and instructive tables.

Intravenous and Intramuscular Injections of Large Doses of Antitoxin in the Treatment of Diphtheria.—BERLIN (*Deutsch. med. Woch.*, 1910, xxxvi, 210) writes of his experience with the intravenous and intramuscular injections of antitoxin in 120 cases of diphtheria. He found that from 4000 to 16,000 units had a much quicker curative effect than smaller doses. In 34 cases the temperature became normal on the day following the injection, and in 28 cases this happened on the second day. Coincidentally with the fall in temperature the pulse rate fell and there was a marked improvement in the general condition. The improvement in the local inflammation in the throat was not so marked. Berlin prefers the intravenous method, and injects the serum into one of the arm veins. In the case of children intramuscular injections into the gluteal muscles are preferable. Berlin believes this method is harmless, and advocates it especially when quick results are desired.

Autoserotherapy of Ascites.—AUDIBERT and MOUGES (*Presse médicale*, 1910, xviii, 81) report their results in a case of ascites due to liver disease treated by subcutaneous injections of the patient's own ascitic fluid. Their technique is similar to that of Gilbert in tuberculous pleurisy. They aspirate the fluid by means of an aspirating syringe and divert the needle into the subcutaneous tissue when withdrawing the needle from the peritoneal cavity. In the case reported they commenced with an injection of 3 c.c., and gradually increased this dose to 10 c.c. The injections were made at intervals of six days, and twelve

injections were given. The procedure was painless and there was no local or general reaction resulting from the injection. They claim that the injections caused an abundant and persistent diuresis, which was the main factor in producing the subsidence of the ascites. Coincidentally with the diminution in the ascites there was a marked improvement in the general condition. Audibert and Mouges withdrew salt from the diet, and consider this withdrawal an important part of the treatment. However, they apparently do not consider that the withdrawal of salt might explain in great measure the diuresis.

The Treatment of Carcinoma with Body Fluids of a Recovered Case.—HODENPYL (*Med. Record*, 1910, lxxvii, 359) describes a case of carcinoma of the breast that apparently terminated in a spontaneous cure. Four years ago the patient underwent a radical operation. The morphology of the tumor was typical of a rapidly growing carcinoma. Multiple recurrences appeared in the neck and in the scar resulting from the operation. These were removed, but further recurrences developed in the neck and breast which were not removed owing to the general condition of the patient and certain local complications. Later, large tumors developed in the liver, so that the liver nearly filled the abdominal cavity. This was followed by an excessive chyloform ascites. The prognosis was considered hopeless. However, the tumors in the neck and breast gradually disappeared. The abdominal tumors gradually diminished in size until the liver became approximately normal in size and position. The chyloform ascites which necessitates frequent tapping is the only marked remaining indication of the previous trouble. Hodenpyl, on the theory that there was some curative substance in the ascitic fluid, tested the effects of injections of the ascitic fluid into mice that had developed tumors as a result of inoculation with some of the well-known strains of mouse cancer cells. He injected the ascitic fluid into the tumors, adjacent to the tumors, or into tissues remote from the tumors. The effect of these injections was a marked necrosis of the tumors leading to a considerable diminution in their size and often to their complete disappearance. The harmlessness of the ascitic fluid was first determined by injections into animals and into human beings, and then Hodenpyl tried its effects in cases of carcinoma of various types in man. Small injections were made near or directly into the tumors, or large amounts of the fluid were injected intravenously. A temporary redness, swelling, and tenderness occurred about the tumors. This soon subsided and was followed by a softening and necrosis of the tumor tissue which was either absorbed or discharged externally. The tumors have grown smaller in all cases, and in some cases have entirely disappeared. The injections have had no effect upon other tissue than tumor tissue, and there has been no systemic effect even after large intravenous injections.

The Management of Glycosuria in Elderly Persons.—VAUGHAN (*New York Med. Jour.*, 1910, xci, 417) says that the glycosuria of elderly patients is very often dietetic and is frequently due to the excessive ingestion of some particular forms of carbohydrate. The particular forms of carbohydrate that are not tolerated should be detected and

excluded from the diet. Furthermore, the limit of tolerance for other carbohydrates should be determined and these carbohydrates given to the point of tolerance. Vaughan states that the capacity for assimilating carbohydrates depends largely upon the time of day they are ingested. Thus glycosurics who excrete sugar upon carbohydrates taken at breakfast may dispose of 100 grams of carbohydrates taken at a six o'clock dinner. Finally, Vaughan lays stress upon the value of the open-air treatment of this form of glycosuria. He thinks that sleeping in the open air is as beneficial to the glycosuric patient as to the tuberculous patient.

Acidosis in Diabetes and the Value of the Oatmeal Cure.—TÜTHJE (*Therapie d. Gegenwart*, 1910, li, 8) writes that in general the daily amount of acetone bodies excreted in the urine gives a measure of the severity of the disease. He believes, however, that the administration of alkalis can markedly increase the excretion of the acetone bodies without any increase in the formation of these bodies, and consequently without any added danger to the patient. Furthermore, he believes that the harmful effects of the acetone bodies is dependent upon the duration of the acidosis. Thus, an acidosis of a mild degree, but long continued, is more to be feared than a higher acidosis of short duration. The acidosis that persists when a patient remains sugar-free on a strict meat and fat diet is harmless according to Tüthje. Therefore, he believes it is not necessary to change the strict diet so long as the patient remains sugar-free. However, if such a patient excretes sugar, a daily quantitative estimation of the acidosis is necessary for a rational treatment. Tüthje speaks of the good effects of the oatmeal diet in severe cases of diabetes with acidosis, and advances an hypothesis for its action. He suggests that the oatmeal starch may exercise a true exciting action upon the fermentative processes which possibly play a part in the metabolism of glucose in the body.

The Determination of Acidosis in Diabetes from a Therapeutic Standpoint.—BLUM (*Therapie der Gegenwart*, 1910, li, 97) calls attention to the articles of Tüthje and of Gulmuyden, who claim that a quantitative estimation of the acetone bodies is necessary for a rational treatment of severe cases of diabetes. Blum agrees with their findings that such a quantitative estimation is ideal, but points out the practical difficulties of such an estimation. He suggests the determination of the ammonia nitrogen as a measure of the severity of the acidosis. Such a determination is simple and is an accurate measure of the grade of acidosis when no alkali is being taken by the patient. Blum believes that the amount of alkali necessary to render the urine alkaline is a measure of the severity of the acidosis, and he advocates this method of determining the severity of the acidosis. Normally from 5 to 10 grams of sodium bicarbonate are sufficient to make the urine alkaline. Mild cases of acidosis require 20 grams of sodium bicarbonate, moderately severe cases require 20 to 30 grams, and severe cases require 50 grams and over. It is often impossible to render the urine alkaline, especially in cases of acidosis that have advanced as far as coma. Blum believes that the carbohydrates should never be entirely withdrawn until the urine has been rendered alkaline.

The Dietetic Treatment of Uric Acid Diathesis and Gout.—BESSAU and SCHMID (*Therap. Monatshe.*, 1910, xxiv, 116) discuss briefly the part played in gout and the uric acid diathesis by the exogenous uric acid. They include in their article valuable tables of the purin content of various foods. They found that there was no appreciable difference in the purin content of red and white meat and but little difference in the meat of different species of animals. In general the purin content was greater in the smaller species of animals. Fish contained approximately a higher purin content than meat. The purin content of such small fish as sardines, anchovies, and sprats was very high. Consequently they consider that they, with liver, kidneys, and thymus, belong to the purin-rich foods. They also found that spinach, peas, beans, and lentils contained a high percentage of purin bases. Some varieties of mushrooms were also found to be rich in purin bases. Bessau and Schmid state that the part played in uric acid metabolism by purin bases derived from vegetables is not definitely known, but that they are not to be disregarded as a possible source of exogenous uric acid.

Glycerin in the Treatment of Pernicious Anemia.—VETLESEN (*Semaine Méd.*, 1910, xxx, 45) has used glycerin with success in the treatment of two cases of pernicious anemia. He bases this treatment on the theory that pernicious anemia is due to the hemolytic action of a lipoid substance similar to oleic acid. Glycerin forms an inert ether (triolein) when combined with oleic acid, according to Vetlesen. Therefore he gave the glycerin, hoping for a similar combination with the lipoid substance, which is, according to this theory, the cause of pernicious anemia. Half an ounce of glycerin with the juice of half a lemon is given three times a day. In one case treated by this method the blood showed a hemoglobin percentage of 20 and a red cell count of 900,000, with corresponding changes in the morphology of the red blood cells. After seven weeks treatment the hemoglobin content increased to 90 per cent. and the number of red cells to 4,700,000. The patient also gained about thirty pounds in weight.

Veronal in Delirium Tremens.—MÖLLER (*Berl. klin. Woch.*, 1909, xli, 2340) reports good results with the use of veronal in delirium tremens. His routine method of treatment is as follows: On admission into the hospital, one gram of veronal was given, and if no sleep followed within three hours, a second dose of one gram was given. This second dose was seldom required. A third dose may be given within five to six hours in very severe cases. Sleep usually came on rapidly and lasted from six to twelve hours. The patient usually was clear and quiet upon awakening. A half gram of veronal was sufficient to control any tremor if present. If insomina persisted, a half gram of veronal given at night was ordered. Of over 100 cases treated, this treatment only failed in 3. Of this series only 2 died, 1 as a result of a double pneumonia, the other from general weakness due to repeated attacks of delirium tremens. Möller says that this method of treating delirium tremens has the great advantage that it is eminently suitable for home treatment.

PEDIATRICS.

UNDER THE CHARGE OF

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The Bacteriology of Acute Infections of the Respiratory Tract in Children.—L. EMMETT HOLT (*Archiv. Int. Med.*, 1910, v, 449), on account of the increase of acute respiratory diseases among children, especially in institutions, has made a study to determine how much of the trouble was due to influenza. Nothing was accepted as of diagnostic value except the presence of Pfeiffer's bacillus. Cultures were taken from all cases of catarrhal inflammation of the upper and lower respiratory tract, and also from cases of pneumonia, empyema, otitis, and all febrile cases of doubtful diagnosis. Blood-agar plates were used for all cultures. Observations were made on 250 children and cultures obtained from the blood of 59 consecutive autopsies. The *Bacillus influenzae* was discovered by culture in 85 cases. Of 47 cases of acute bronchitis and pneumonia during winter and spring, the bacillus of influenza was found in 63 per cent. During the warm months this bacillus disappeared and was found only once. Pneumococcal infection, however, persisted during the hot weather. Cultures made after paracentesis in 29 cases of acute otitis showed the staphylococcus 25 times, the pneumococcus nine times, and the bacillus of influenza not a single time; and yet 15 of these 29 cases gave positive throat cultures for *Bacillus influenzae*. Cultures were made from the lungs and heart's blood in 59 consecutive autopsies. Of the 47 made in winter and spring, 17 showed the bacillus of Pfeiffer. In the 12 autopsies made in summer the bacillus was not found. Of 58 persons suspected of having influenza, the throat cultures were positive in 42 and negative in 16 cases. The proportion of positive throat cultures in suspected cases, 73 per cent., is large enough to warrant it an important result. *Bacillus influenzae* is pathogenic and plays a more important part at certain seasons of the year. It is often associated with the pneumococcus, modifying the clinical course of a pneumonia. 16 healthy persons showed *Bacillus influenzae* repeatedly, often in pure culture. These become real sources of danger as carriers. Acute otitis is to be regarded as a complication of influenza. Acute nephritis may occur as a complication. Recurrent attacks of influenza are probably relapses and not fresh infections from without. No single clinical type is diagnostic of influenza. The lower respiratory tract is the favorite seat of the bacillus and it may persist there for weeks.

Constipation in Infants.—ERIC PRITCHARD (*Practitioner*, 1910, lxxxiv, 583) states that constipation is nearly always due to mechanical interference at the colon and sigmoid, or to dislocation of the sensitive reflex of the rectum. In cases of nervous debility with loss of tone of the muscles, the intestinal musculature is also involved. Constipation is one of the most frequent complications of rickets, and there is a tendency to it in meningitis and in cretins and mentally defective

infants. Irregular habits are usually formed during the first few weeks of a baby's life, purgative drugs being especially harmful. The nerve centres in the cord tend to fall into periodic habits from recurring stimuli. Severe attacks of diarrhoea predispose to subsequent constipation. A deficient quantity of food is a common cause in breast-fed infants. Constipation from overfeeding is more common in bottle-fed infants. The particular element of food responsible is still in doubt or dispute. The following conditions may cause constipation: Congenital malformations; acquired structural alteration; interference with the nervous mechanism of peristalsis and defecation; faults in the intestinal contents; insufficiency and deficiency of fluid. Prophylaxis is the best form of treatment. A test feed should be taken, weighing the baby before and after a feeding to determine the quantity it is getting. Periodicity of evacuations should be encouraged. Do not under- or overfeed, nor use aperients and purgatives. Pritchard offers as a good lubricant, pure liquid petroleum, 20 minims to the dram in emulsion. He also suggests aromatic elixir of cascara and tincture of nux vomica in emulsion of petroleum.

The Condition of the Blood in Pertussis.—HUGH T. ASHBY (*Brit. Med. Jour.*, 1910, i, 1105) has made a study of the blood of nearly 100 children suffering from pertussis. A differential count was made in every case. The age of the children was from nine months to nine years. The blood was taken at various stages of the disease, and specimens from the same case were repeatedly examined. In a fair proportion of cases the number of leukocytes was increased from 15,000, to 30,000. The hemoglobin and the number of red corpuscles showed no important variations. Leukocytosis is a valuable aid in the diagnosis of suspicious cases. Only in rare instances did the leukocytes reach this number in bronchitis and afebrile chest conditions. In those cases with a well-defined whoop the lymphocytes formed about 60 per cent. of the white cells. The preponderance of the lymphocytes, especially the small variety, is noticeable. After the whooping stage is passed the lymphocytes diminish, and reach the normal number in about two months. The total number of polymorphonuclear cells is but slightly increased. If the lymphocytes form nearly 60 per cent. of the number of white cells it is confirmatory evidence of pertussis. In septic conditions the polymorphonuclear cells are increased in number.

OBSTETRICS.

UNDER THE CHARGE OF

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Pubiotomy a Justifiable Operation.—WILLIAMS (*Amer. Jour. Obst.*, May, 1910) publishes the results of 25 pubiotomies, with no maternal and three foetal deaths, one of which could be attributed to the opera-

tion. These patients were delivered by forceps or version immediately after the operation. The bladder was uninjured and there were six perineal and five deep communicating vaginal tears in the series. Twelve of the cases were primiparæ. The absence of severe injury was attributed to restricting the operation to moderate grades of pelvic contraction, the use of Döderlein's method, and extensive manual dilatation of the vagina and perineum before operation. In delivering the child, to avoid injury it is best to make horizontal instead of upward traction. In the after treatment, a four-inch strip of adhesive plaster was sufficient to hold the pelvis. Patients usually moved in bed between two and four days, were out of bed by the twentieth, and were discharged on the thirtieth day with satisfactory locomotion. Healing occurred by fibrous union, leaving well-defined mobility between the ends of the bone in two-thirds of the cases. Williams estimates that maternal mortality should not exceed 2 per cent. with competent operators and in uninfected unexhausted patients. The operation is indicated in contracted pelvis with a true conjugate above 7 cm., and in funnel-shaped pelvis after a test of several hours in the second stage of labor has shown the necessity for operation. In breech extractions, and in transverse presentations treated by version, it may be best to place the saw in position before delivery, so that the pelvis can be opened as soon as it can be seen that the child cannot pass without difficulty. In multiparæ with repeated difficult labors, or in primiparæ with excessive disproportion, pubiotomy is inferior to Cesarean section at the end of pregnancy or the beginning of labor. Williams takes the view that the test of labor renders Cesarean section dangerous, but does not prevent the successful performance of pubiotomy in cases of moderate pelvic contraction. He believes that in uninfected women pubiotomy should replace high forceps, prophylactic version, induction of labor, and craniotomy upon the living child. It is not to be employed upon infected patients or after other means to deliver have failed. It must be considered as a primary operation the dangers of which are infection, hemorrhage, and deep lacerations. When, during the operation, the ends of the bone do not separate wider than 4 or 5 cm., patients recover well and are able to walk and work as well as ever. Permanent enlargement of the pelvis in the transverse diameter of the outlet, and, to a slight degree, in the true conjugate, follows the operation when the pelvis heals with fibrous union. This enlargement, in a subsequent pregnancy, may be sufficient to permit spontaneous labor. If not, the operation may be repeated, while Cesarean section should be limited to cases in which the pelvic contraction is marked and the child is large.

Five Cases of Hebotomy.—HOLLÄNDER (*L'Obstétrique*, April, 1910) reports five cases of hebotomy after Döderlein's method in which the mothers recovered. There were no wounds of the bladder nor serious hemorrhage. The puerperal period showed fever in one case. In one patient elevation of temperature after delivery was found to be due to tuberculosis. In one patient the child presented by the breech and was born asphyxiated, and could not be revived. In this case delivery by section would undoubtedly have saved the life of the infant. In one patient there was flat and generally rachitic pelvis with a true

conjugate of 8 cm. After the pelvis had been opened there was very little rotation of the two halves, and it was found that at the left sacro-iliac articulation there was cicatricial tissue which prevented rotation at the joint. This cicatricial tissue made a practical ankylosis. In this patient, after pubiotomy, the child could not be delivered by forceps, and craniotomy was necessary.

The Duration of the Second Stage of Labor and its Influence on Mother and Child.—KÖNIGSBERGER (*Zntrbl. f. Gyn.*, No. 18, 1910) has observed 5000 cases in which labor was unduly prolonged in the second stage. In the more severe of these cases the patient's life was endangered through laceration of the soft parts, fever, septic infection, and rupture or atony of the uterus; while the child was brought in danger through asphyxia. It was observed that when the second stage of labor lasted more than eight hours the mortality for mothers reached 15 per cent. The percentage of fatal asphyxia among the children rose from 1 per cent., its normal average, to 10 per cent., when the second stage of labor lasted more than eight hours.

A Case of Precipitate Labor Causing the Death of the Infant.—HAUER (*Zntrbl. f. Gynäkologie*, No. 18, 1910) reports the case of a patient in her second pregnancy, who was suddenly delivered while standing. The whole duration of labor was but fifteen minutes. The child fell upon the floor, the umbilical cord ruptured, and the mother fainted. The child weighed 3480 grams, and died from hemorrhage from the torn umbilical cord. The mother recovered. The case is interesting from a medicolegal standpoint, as illustrating the death of the child without the connivance or action of the mother. Hemorrhage from the torn umbilical cord rarely becomes serious, and had the mother remained conscious, suspicion might naturally have been aroused regarding her possible action in the matter.

The Treatment of Placenta Prævia in the Munich Clinic.—MAISON (*Zntrbl. f. Gynäk.*, No. 18, 1910) reports 154 cases of placenta prævia treated by the use of the tampon, elastic bags, ruptured membranes, or version. The entire mortality of the mothers was 14 per cent. In central placenta prævia the mortality rose to 28 per cent., while the death rate for the children was 75.8 per cent. If only those cases are reckoned in which the child was in fair condition upon admission, the mortality is reduced to 68.7 per cent. The highest mortality rate for the mothers followed the use of the tampon in treatment, and reached 25 per cent.; of the children, 70 per cent. Maternal deaths occurred in these cases partly from bleeding and partly from septic infection. The worst results were seen in Polyclinic cases treated by the tampon. The cases treated by the Braxton-Hicks method were divided into two groups, in one of which extraction immediately followed version; while in the other extraction was delayed. In 31 cases treated by version without extraction, the maternal mortality was 10 per cent.; the foetal mortality 80 per cent. The mortality of the children when extraction immediately followed version was 60 per cent., without maternal mortality.

Congenital Dislocation of the Kidney into the Pelvis Complicating Pregnancy.—HALBEIN (*Wien. med. Woch.*, No. 4, 1910) reports the case of a multipara who had a tumor in the small pelvis. It was found that this was in such a position that labor could not occur, and accordingly abdominal section was performed. The tumor was found to be a good sized healthy kidney. It was carried upward under the sigmoid flexure to the capsule of the kidney and sutured to the peritoneum. The patient suffered from abortion. Experience shows that 80 per cent. of these cases are upon the left side, and that they are sufficiently frequent to occasion confusion in diagnosis. Malformation of the genital tract is often present, and operation is frequently necessary for successful delivery. The kidney should not be removed unless it is found essentially diseased, but whenever possible operation should not be undertaken until the patient has recovered from pregnancy and labor. If the kidney is diseased it should be removed. Should it be necessary to perform Cesarean section, the kidney should be fixed in its normal position at the conclusion of the operation.

Villous Toxemia and the Serum Diagnosis of Early Pregnancy.—FIEUX and MAURIAC (*Ann. de gyn. et d'obst.*, February, 1910) believe that in early pregnancy there is intoxication from the villi of the chorion, which makes the serum diagnosis of pregnancy a possibility. This seems probable, because some of the diseases of pregnancy occur early and cease immediately when the ovum dies. Should the ovum persist, these disorders gradually cease about the third or fourth month, when the syncytium is less active. Should an extensive degeneration of the chorion occur, as in hydatid degeneration, the patient may become worse. Eclampsia usually develops comparatively late in pregnancy when the syncytium is not abundant, while the villi of the chorion are best developed in early pregnancy. A villous toxemia theoretically should be found early in pregnancy. The writers endeavor to demonstrate this by making an antigen, the portions of the placenta being removed from the sixth to the tenth week of pregnancy. In 55 observations 5 were negative in pregnancy lasting from three to five weeks; 8 were positive in pregnancy lasting from two to three months; and in pregnancy from three to four months, 1 was positive, 4 negative, and 2 doubtful; in 14 cases from the fourth to the ninth month of pregnancy all gave negative results. Negative results were also obtained in 10 patients in whom pregnancy could not be diagnosticated by its clinical signs. In 3 abortions, from the second to the third month of gestation, results were positive; while in 7 cases from the fourth and fifth months of pregnancy, the results were all negative. These observations led to the conclusion that in some periods of gestation the blood of pregnant patients contains a substance which in the presence of young villi disturbs the equilibrium of metabolism. The antibody in the blood appears when the chorion is most active. Its function is to neutralize poisons formed in the placenta and check the activity of the trophoblasts. Patients were examined who had fibroid tumors and who had syphilis but were not pregnant, and in these the reaction was not obtained. These observations recall those of Grafenberg, who isolated a ferment from the chorion between the second and fourth months of pregnancy. This presumably acts upon the internal tissues, permitting their penetration by villi.

GYNECOLOGY.

UNDER THE CHARGE OF

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The Spread of Carcinoma by the Fallopian Tube.—GLENDINING (*Jour. Obst. and Gyn., Brit. Emp.*, 1910, xvii, 24) records a preliminary note on two cases of secondary carcinoma disseminated by the Fallopian tube occurring in association with secondary growth in the ovary. In each instance the primary growth was in the stomach. In both instances there were found in the Fallopian tube, and permeating its tissues, numerous minute and discrete cancerous deposits arranged in such a manner that it is not at once easy to determine in what direction they are passing, or at what point or points they have entered the tissues. He believes the microscopic study of these tissues, together with some other points brought out, prove that cancer cells floating in the peritoneal cavity are swept into the lumen of the Fallopian tube, and there coming in contact with the lining, pass through the columnar epithelium to enter the lymphatic spaces of the subepithelial and muscular tissues, and so pass into the mesosalpinx. This method, Glendining believes, has never been mentioned in literature.

Primary Cancer of the Fallopian Tube.—Primary cancer of the Fallopian tube is made the principal feature of the January, 1910, number of the *Jour. Obst. and Gyn., Brit. Emp.* Besides the article of DORAN and GLENDINING abstracted and appearing herein are clinical reports of three cases by Herbert Spencer, one by Tatc, and one by Legg. A careful microscopic study is reported by each recorder.

Changes in the Normal Endometrium During Menstrual Life.—NORRIS and KEENE (*Surg., Gyn., and Obst.*, 1910, x, 44) have carefully studied the changes in the normal endometrium during menstrual life. One hundred cases constituted the material studied. It is concluded that the endometrium in the normally menstruating woman undergoes a complete and definite cycle every twenty-eight days. For the purpose of study, this cycle is best divided into four periods which blend into each other. During the period which constitutes the premenstrual process the endometrium takes on all of the changes common to the decidua vera at a very early stage, only at this time the changes are of a lesser degree. As soon as free hemorrhage occurs, the congestion is relieved. The postmenstrual and interval periods constitute a process of repair. Each of these periods possesses definite histological characteristics, the most typical changes being found in the premenstrual and postmenstrual periods. As has been said, the periods blend into each other and are subject to slight variations in different individuals. The menstrual period lasts from four to six days, the postmenstrual three to five days, the interval from ten to twelve days,

and the premenstrual about ten days. It is therefore important that the pathologist, when examining endometrium, should know when the last menstrual period occurred. This knowledge, combined with an understanding of the changes during the various transformations of the normal endometrium, will show that many of the cases diagnosed as glandular or interstitial endometritis are nothing more than different periods of the normal endometrium, and, consequently, that endometritis, in the true sense of the term, is much less frequent than is commonly thought. In the classification of endometritis, they recommend its division into acute and chronic, doing away with the cumbersome and faulty classifications which are now used.

The Subinvolved Uterus.—R. R. SMITH (*Surg., Gyn., and Obst.*, 1910, x, 17) reports his study of the changes in the uterus occurring in subinvolution of that organ. This study is extended into the treatment of that condition, which included various plastic operations, the employment of drugs, and waiting for the menopause to produce atrophy. Smith believes there is a class of cases that cannot be successfully treated by such measures; in fact, only removal of the body of or the whole of the uterus will suffice, and records 23 cases thus treated successfully. In 9 the blood loss at or between menstrual periods was very serious. In 9 there was great pelvic discomfort. Retroversion and prolapse were present in 7. The principal reasons for hysterectomy were long continuance of the symptoms, severe loss of blood, the non-relief by simple procedures, the age of the patient, and the size and condition of the uterus.

Tetanus Developing Twelve Days after Shortening the Round Ligaments.—R. PETERSON (*Jour. Amer. Med. Assoc.*, 1910, liv, 108) reports a case of tetanus developing twelve days after an operation for shortening the round ligaments, and his conclusions are based upon this case and 150 others following surgical operations found in literature. From these Peterson concludes: (1) While tetanus cannot be said to be a very frequent postoperative complication, a study of the reported cases shows it does occasionally follow all kinds of gynecological operations. (2) It most frequently is a complication of operations involving the opening of the peritoneal cavity, although in quite a percentage of cases it complicates plastic and other non-peritoneal operations. (3) The infection in all probabilities is introduced at the time of operation. (4) It has been proved that the tetanus bacillus and its spores are most difficult to kill, and that under certain circumstances they survive boiling for sixty minutes; hence when this organism is present more than ordinary heat, applied over a longer time, is necessary. (5) Absorbable ligatures, like catgut, may be carriers of the infection, unless the most approved methods of sterilization be employed. (6) The process of manufacture of the catgut renders it peculiarly liable to infection by the tetanus bacillus, which may not be destroyed by the ordinary methods of chemical sterilization. (7) The initial symptoms of postoperative tetanus appear within ten days in from two-thirds to four-fifths of the cases. The onset of symptoms in the remaining cases varies from the eleventh to the twenty-second day after the operation. (8) In the 150 cases tabulated no case showed symptoms of tetanus the first two days after

the operation. (9) From a study of these cases it would seem that the average period of incubation for postoperative tetanus was about eight days. (10) The shorter the incubation period the more virulent and active the disease, and, conversely, the longer the incubation the milder the disease or the longer is it possible for the patient to survive before a fatal issue. (11) Whenever possible the point of entrance of the tetanus bacilli should be ascertained and the proper disinfection and drainage instituted. This is often difficult in cases of postoperative tetanus. (12) Antitetanic serum acts on the free toxins in the blood, but has no effect on the toxins after they have become fixed in the nerve cells. (13) A study of the tables shows that the mortality of tetanus has been reduced nearly 10 per cent. through the use of antitetanic serum. (14) The best effects of the serum will be seen when its administration is begun on the first appearance of the symptoms of the disease. (15) Chlorotone is able to control the muscular spasms of tetanus and to do away with the muscular rigidity. It is harmless and does not prevent elimination. (16) In tetanus, elimination through free catharsis and the administration of salt solution is of the utmost importance.

Is the Routine Exhibition of the Pre-operative Purge Defensible?—EDWIN WALKER (*Amer. Jour. Obst.*, 1910, lxi, 63) discusses the subject of the routine employment of purgatives in the preparation of patients for operation, and concludes the practice is pernicious. Of it Walker says purgatives can do harm and should be given only when indications are clear. The profession should abandon the slipshod, routine methods now in vogue and should teach the laity, both by precept and example, the evils of the purgative habit. The practice of purging all patients before surgical operations is unnecessary and injurious; they are made more uncomfortable, are weakened, and the condition of the intestinal canal is not rendered more favorable, but, on the contrary, germ activity is stimulated just as it is in enteritis, increasing the probability of infection when the gut is opened, and there is in addition to this more postoperative tympany. A diet of digestible food for twenty-four hours or more and a fast of eight or twelve hours before, puts the intestine in the best possible condition for any operation, especially on the intestinal canal, except where obstructive lesions exist, and for these purgatives are worse than useless, and other measures are required. In a few cases of milder fecal stasis a purgative several days before operation, followed by enemas are of service; these are, however, extremely rare. The routine use of any powerful drug is to be deplored, and the habitual pre-operative purge is indefensible.

Pelvic Transplantation Metastasis as a Means of Recognition of Hopeless Abdominal Carcinoma.—DUDLEY W. PALMER (*Surg., Gyn., and Obst.*, 1910, x, 154) has studied pelvic transplantation metastasis of abdominal carcinoma and has found it is so very common that he has reached conclusions as follows: (1) Rectal examination is absolutely necessary in all abdominal tumors. (2) Of 435 consecutive cases of carcinoma of the upper abdomen 6.5 per cent. showed pelvic transplantation deposits as the earliest clinical sign of inoperability. 7.2 per cent. of stomach carcinomas had this sign. (3) 55 per cent. more cases

were shown to be inoperable, through a thorough rectal examination for pelvic metastasis, than because of the presence of supraclavicular gland metastasis. (4) Pelvic metastasis warrants a most unfavorable prognosis as regards life expectancy.

DISEASES OF THE LARYNX AND CONTIGUOUS STRUCTURES.

UNDER THE CHARGE OF

J. SOLIS-COHEN, M.D.,
OF PHILADELPHIA.

Tuberculosis of the Trachea and Thyroid Gland.—GUTHRIE (*Jour. Laryng.*, May, 1910) reports a case of tuberculous disease of the trachea leading to cartilage necrosis and involvement of the thyroid gland. A man, aged forty years, with pulmonary tuberculosis, left a sanatorium within two months after entrance without further physical signs of disease, and with entire absence of bacilli. There was slight respiratory stridor, apparently due to a mass in the anterior portion of the trachea about an inch below the glottis. Tracheotomy was performed under local anesthesia, and on exposure of the isthmus of the thyroid gland it was found infiltrated with newgrowth. Division of the isthmus revealed erosion of portions of the first and second tracheal rings at this point, whence an opening led through a mass of growth into the lumen of the upper end of the trachea. Masses removed from both these situations showed marked tuberculous changes. A few days later the tuberculous masses were removed after splitting the larynx, all surfaces were scraped and rubbed with pure lactic acid, and the lumen was then packed with iodoform gauze down to the level of the tracheotomy tube. The patient did well, and when last seen, some six months before this report, there was no evidence of the return of the tracheal disease.

Sarcoma of the Nose.—PRICE BROWN (*Canadian Jour. Med. and Surg.*, January, 1910) reports a number of cases in which he had successfully relieved the patient of sarcoma of the nose by treatment with the electrocautery. Of seven cases, three had permanently recovered, there having been no return after intervals of fourteen, seven, and two and three-quarter years. The fourth died from toxemic poisoning. The fifth had no return in seven months, and the sixth and seventh had no return in the last two months.

Iodine in Diseases of the Mouth.—TALBOT (*Jour. Amer. Med. Assoc.*, April 2, 1910) lauds the topical application of tincture of iodine in diseases of the mouth. He specially recommends a solution containing zinc iodide, 15 parts; water, 10 parts; iodine, 25 parts; and

glycerin, 50 parts, to be painted monthly, during the school term, over the gums and mucous membrane of public school children to prevent infection and to retard the decay of the teeth.

Palatopharyngeal Adhesions the Result of Traumatism in Operation Upon the Tonsils.—In discussing palatopharyngeal adhesions and the methods adopted for their relief, ROE (*Jour. Amer. Med. Assoc.*, January 15, 1910) describes a new operation which he devised for the relief of a case of practically complete occlusion in a woman, aged twenty-four years, whose condition was the result of traumatism which had been produced in attempting to excise the tonsils one year previously. Practically, the operation consists in separating the parts and covering the raw surfaces with plastic flaps taken from the sound sides of the palate and passed from before backward. For details the reader must be referred to the original.

Tuberculosis of the Œsophagus.—GUISEZ (*Archives internat. de laryngologie, d'otologie, et de rhinologie*, March and April, 1910) reports several cases of tuberculosis of the œsophagus. He distinguishes three forms: (1) Superficial ulceration at the uppermost portion of the œsophagus, announced by painful dysphagia, and attended with spasm or contracture just above the lesion. (2) And more frequently tuberculosis by propagation, with symptoms of œsophagical compression, the walls having to be pushed aside by the œsophagoscope during inspection. (3) The sclerotic type, described by Schrötter, and certainly the rarest. In this the dysphagia is not painful. There is a concentric thickening of sclerocicatricial consistence, as determined by pressure with a probe.

Papilloma of the Larynx and Palate in the Same Subject.—WYLIE (*Jour. Laryng.*, April, 1910) reports the case of a cabdriver, aged forty years, with hoarseness of eight months' duration, and attacks of dyspnoea latterly on lying down. A large subglottic papilloma was seen in the anterior commissure of the larynx, and there were two papillomatous growths on the edge of the soft palate at equal distances from the uvula.

Singers' Node.—PORTER (*Jour. Laryng.*, April, 1910) reports a case of singers' node removed with forceps. Perfect functioning resulted. A microphotograph of the section shows several layers of epithelium on the surface, with vascular connective tissue below, in one part of which the nuclear stain had taken somewhat faintly.

Traumatic Injury of the Upper Air Passages from Formaldehyde.—ELY (*Jour. Amer. Med. Assoc.*, April 2, 1910) reports a case of a boy, aged three years, who attempted to drink a few drops of a 40 per cent. solution of formaldehyde. Postmortem examination, six hours after death, showed a marked thickening of the mucous and submucous coats of the epiglottis, larynx, and trachea, with a superficial necrosis which extended to the bifurcation of the latter. There were no pathological changes discovered in the œsophagus, nor any other evidence of destruction of the mouth and pharynx.

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

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The Etiology and Pathological Anatomy of Rheumatic Myocarditis.—E. BRACHT and WÄCHTER (*Deut. Archiv f. klin. Med.*, 1909, xcvi, Heft 5 and 6) quote Ashoff and Tawara as describing certain nodules in the heart which were specifically characteristic of rheumatic myocarditis. The specificity of these nodules they say has been disputed by some observers, but all observers have found them. Not all rheumatic cases show the nodules, but where present it is always in rheumatic hearts. The nodules described by the present authors were found in three out of four cases whose clinical diagnosis had been rheumatism. In two of the three cases streptococcus was found in the blood. The authors describe perivascular subendocardial nodules or scars containing large cells and giant cells, and surrounded by a zone of lymphoid elements with occasional leukocytes and plasma cells. Often a proliferation of fibroblastic cells was seen. The adjacent muscle bundles often suffer from pressure, so that when the number is great, distinct effect on the function of the heart muscle results. There seemed to be a tendency for the nodules to occur in the neighborhood of the auriculo-ventricular bundle, with a directly damaging result to that structure. But there are often found in old hearts whose function is undisturbed, many of these rheumatic scars, so that their disposition is apparently more important than their number. Efforts to find a cause for the nodules in the action of bacteria in and about the scars were fruitless. Bracht and Wächter then inoculated animals with *Diplostreptococcus rheumaticus*. Subsequently the heart muscle was found sprinkled with areas of necrosis in which could be seen proliferation of fibroblast cells, going on to the large cell and giant cell formation described above, with an encircling zone of lymphoid cell infiltration and a few plasma cells. Myocarditis produced by other strains of streptococci showed the usual reaction of tissue to bacteria, that is, gathering of polymorphonuclear leukocytes and often abscess formation.

Experiments upon Increased Blood Pressure in Nephritis.—ALWENS (*Deut. Arch. f. klin. Med.*, 1909, xcvi, 137) has modified some methods used by Schlayer to study the effect upon the blood pressure of decreasing the calibre of the renal vessels. It has been long known that one or both renal arteries may be tied off without an accompanying rise in blood pressure, but Katzenstein found in certain experiments that occlusion of the small vessels of the kidney by thrombus masses was followed by an elevation of blood pressure. By means of oncometers

Alwens has compressed the kidneys using a pressure varying from 90 to 135 mm. of Hg. Compression of the entire kidney by this means produces a rise in the systemic pressure of from 20 to 26 mm. of Hg. This phenomenon seems to be absolutely dependent upon compression of the small vessels of the kidney for ligation of the renal artery prevented any rise. He also shows that simple compression of a kidney which is deprived of its blood supply will not influence blood pressure. The reason for this rise of pressure is not perfectly clear. It is apparently not associated with a nervous reflex acting upon the other vessels of the body, for the rise in blood pressure still took place after freeing the kidney pedicle from nerves, section of the splanchnic nerve, and section of the medulla. Neither is it due to a sudden increase in the amount of blood in the body for direct infusion of much larger quantities of fluid is incapable of increasing blood pressure. In spite of the fact that the action seemed independent of the nervous system, still it was thought possible that contraction of the vessels of other organs might account for the rise of pressure. When the left kidney was compressed, however and the right kidney put in an oncometer no change in the size of the kidney was observed. Comparison of the other internal organs gave somewhat similar results. With compression of the spleen the rise in pressure was quite marked, but not constant; with the coils of intestine the rise was still less marked and very inconstant. Compression of the limbs, on the other hand, never gave rise to increased pressure. Alwens believes that compression of the small vessels of the extremities is compensated for by dilatation of the vessels of the internal organs, whereas there is no such mechanism to compensate for the compression of the well protected abdominal organs. The difference in the quantitative changes in the pressure in these experiments and in the contracted kidney in man are so great that it is almost impossible to apply the purely mechanical theory of heightened blood pressure in nephritis upon these grounds.

The Present Status of Trachoma Bodies.—In 1907 Halberstädter and Prowazek described certain bodies which they had found in the epithelial cells of trachoma granules, but which could not be found in the normal conjunctiva or in diseases of the eye other than trachoma. These bodies could be transferred from man to monkey and from animal to animal though every inoculation was not successful. Later Graefe, Frosh, and Clausen stated that they could be found not only in the epithelial cells of the conjunctiva of early cases of trachoma, but in old cases as well and in the eye secretions and cells of the follicles. LINDNER (*Wien. klin. Woch.*, 1909, xxii, 1742), who has studied the question for some time, has confirmed these observations and gives a detailed description of the bodies which he considers to be the cause of the disease. Recently Heymann reported that he had been able to demonstrate bodies in the epithelial cells from cases of conjunctivitis neonatorum which could not be distinguished from those described by Prowazek. To control this discovery Lindner examined 31 cases of conjunctivitis neonatorum. In this category are placed all cases of purulent conjunctivitis of the new born, but 3 cases, which were old must be excluded since the findings were negative. Of the other 28, 13 were due to the gonococcus and though the organisms were occasionally seen within epithelial cells, forming masses which might be mistaken for trachoma

bodies, neither in 12 of these cases nor in 8 cases of gonorrhœal conjunctivitis of adults could true trachoma bodies be found. In one of the cases of gonorrhœal conjunctivitis of the new born, however and in all the other 15 cases of blennorrhœa neonatorum typical trachoma bodies were found. Lindner considers this of great significance and believes that this conjunctivitis of the new born and trachoma are one and the same disease caused by the same parasite. This view was strengthened by the fact that an ape inoculated with material from a case of conjunctivitis neonatorum in which the peculiar bodies were present developed after a preliminary conjunctivitis typical trachoma granules in which were found the trachoma bodies. He believes that infection of the eye takes place during birth and from the vagina, which may be the seat of the disease.

Calcium and Cardiac Inhibition.—It has been shown by Schiff that a solution of physiological sodium chloride allowed to perfuse the heart of a living frog until all the blood is washed away causes immediate cessation of the cardio-inhibitory action of the vagus nerve. BUSQUET and PACHON (*Jour. de. phys. et de path. gen.*, 1909, xi, 807, 851) have repeated and confirmed these experiments in an isolated frog's heart. Many different salts of sodium were employed but they all had the same effect. When minute traces of calcium were added to the saline solution the cardio-inhibitory act on of the vagus was immediately restored and with the removal of the calcium salts was equally rapidly lost. Further experiments showed moreover that calcium was absolutely necessary for the preservation of the cardio-inhibitory action of the vagus. The salts of the nearly allied metals such as K, Sr, Ba, and Mg were all infective. Calcium, however in various forms could be employed with success. It was even active in such organic substances as gum arabic and gelatin. When the salts of Na were injected intramuscularly or subcutaneously the cardio-inhibitory action of the vagus was disturbed only by a small group including the carbonate, oxalate and citrate. These salts, as could be shown later, are capable of making Ca inactive and their action seems to be much the same as in the prevention of coagulation of the blood by decalcification. If in the closed circulation an isotonic solution of NaCl be substituted for the blood the cardio-inhibitory action of the vagus is still well preserved even after twenty hours. This is probably due to the fact that small traces of calcium are constantly being washed from the organs of the body into the blood whence they are carried to the heart.

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ORIGINAL ARTICLES.

TRICHINOSIS.

A CLINICAL STUDY OF FIFTY-TWO SPORADIC CASES.¹

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SINCE the accidental discovery by Frederick Albert Zenker, in 1860, of *Trichina spiralis* as the cause of serious endemics of disease, such endemics and sporadic cases have from time to time been reported in the United States, but trichinosis is usually referred to in the literature as a rarity, and the reports of cases are often so superficial as to argue lack of familiarity with the disease. The fact that I have been able to obtain records of fifty-two sporadic cases occurring during the past six years (observed in my personal practice and in the service of colleagues and myself in the Presbyterian and Bellevue Hospitals) proves that trichinosis is much more common as a sporadic disease than is usually supposed—at least in the vicinity of New York, where there are so many immigrants whose dietetic habits render them liable to infection.

In New York City the Meat Inspectors of the Department of Health direct their examinations mainly to the detection of tuberculous meat, and no systematic microscopic examination is made of the various products of swine flesh.

Owing, moreover, to the frequency with which I have found demonstrable trichinosis unsuspected or wrongly diagnosed, it is

¹ Read at a meeting of the Association of American Physicians, Washington, D.C., May 4, 1910.

my belief that sporadic examples of the disease are much more prevalent than is generally supposed. The following analysis of the fifty-two cases may serve to emphasize the importance of this subject:

In trichinosis the onset of symptoms is acute, either in the form of sudden chills or muscular pains, with vomiting, severe frontal headache, prostration and fever. In a majority of the cases in which the date of infection could be fixed definitely, the onset took place after two weeks' incubation, the extremes being nine days and three weeks. In some cases after an acute onset the patient was better, perhaps able to return to work, when, in a few days, prostration again overtook him.

The vomiting, which is an early symptom in the more severe cases, may be accompanied by intense abdominal cramps and contractures of the leg muscles. Diarrhœa is by no means a constant symptom. I have remarked it as an immediate symptom in several patients who had eaten tainted swine flesh, when it appeared due rather to ptomaine poisoning (*botulismus*) than irritation by the trichinæ. As a later symptom it characterized about one-fifth of the cases. Others exhibited constipation throughout, or constipation alternating with occasional diarrhœa. Tympanites was often present, and in one case there was hemorrhage from the bowel. Repeated search for trichinæ was made in the stools and blood of the patients, but they were never discovered.

Distinct chills or indefinite rigors were present in about one-fourth of the cases, usually occurring within the first few days of the disease. The chills were followed not infrequently by sweating, and profuse sweats were common throughout the grave cases.

Erythema was often manifest in the face and neck, sometimes also over the body. I have not noticed the general pruritus referred to by one or two writers, but have once or twice observed herpes labialis, urticaria, and a macular eruption on the abdomen, not unlike the roseola of typhoid fever. In one of my cases serious epistaxis occurred.

In all the more severe cases there was early complaint of great muscular weakness and prostration, while, sometimes, but by no means uniformly, there was loss of weight. One patient of the series lost fifteen pounds. As a point of distinction from typhoid fever, the loss of weight is not usually commensurate with the extent or duration of the temperature in trichinosis. The muscle pains and tenderness are usually very general and severe, but in many cases the pains were most intense in special groups of muscles, especially in the arms, calves of the legs, and thighs. Tenderness over the diaphragm was common. In exceptional cases the muscular pains and tenderness were so slight as to be very little complained of, at least at the time when the patient came under observation. In such cases the trichinæ are probably already firmly encysted.

The eye symptoms were interesting. Severe pain and burning sensations in the eyes were usually complained of, and were distinctly localized, independent of the headache. I have seen three cases in which there was circumscribed corneal hemorrhage, bilateral and close to the iris, which probably was due to local irritation by the trichinæ. In one additional case only was vision affected temporarily. There was an optic neuritis with œdema of the retina near the optic nerve, and small hemorrhages in the macular region of the left eye, while the fundus resembled that of acute nephritis. From time to time small fresh hemorrhages appeared in both eyes, but the process entirely cleared up.

F. J. Parker² reported several cases from the Presbyterian Hospital dispensary, among which were four with tenderness of the eye globes on pressure, diplopia, and pain on rotation. In four cases there was conjunctivitis, and in one neuroretinitis with œdema and hemorrhage of the retina. In two there were subconjunctival ecchymoses.

C. Stauble³ reports a case with subcorneal ecchymosis and Kratz observed this symptom in eight patients in an epidemic of 264 cases in Hedersleben. Dilatation of the pupils has also been recorded.

œdema of the eyelids was present in one-fourth of the cases of my series, at some time during their course. It may be so slight as to escape the patient's notice, or severe and accompanied by swelling of the cheeks and forehead, so as to make the face resemble the appearance in acute nephritis.

œdema of the ankles was common, and sometimes there was swelling about such major joints as the knees and elbows, an appearance which often has led to a mistaken diagnosis of rheumatism. The œdema occurs irrespective of the localization of pain.

Cough was present in a number of cases, with slight bronchitis, probably due to irritation of the bronchi by the parasites, but the latter were not found in any of the sputum examined.

Dyspnœa was a very common symptom, but it was usually objective rather than subjective, and unaccompanied by pulmonary signs or cyanosis. It often appeared to be due to invasion of the diaphragm muscle by the trichinæ, for in such cases the abdomen was markedly sore and the type of breathing thoracic. The maximum rate of breathing observed in any case was 60, and in a number of cases it reached 36.

The urine, as a rule, presented few abnormalities, but in some cases scattered red blood corpuscles and a trace of albumin were observed. In one patient a subacute nephritis developed, and in a case seen in consultation there was an acute hemorrhagic nephritis with excessive hemoglobinuria. In this case, however, the urine

² Medical Record, August 3, 1907, p. 179.

³ "Trichinosis," Weisbaden, 1909, p. 59.

was also "smoky," as in carbolic acid poisoning, and the patient had been drugged with an excess of potassium iodide and salicylates, in the mistaken belief that he was suffering from obstinate rheumatism. Micturition sometimes is painful. A positive diazo reaction frequently was obtained.

The leukocytosis, as a rule, was not excessive, and apparently never as high as it may be in many purulent infections, pneumonia, gas poisoning, etc. In one-third of the cases it was not above 15,000, and in only three cases was it above 32,000, the maximum being 40,200. Polynucleosis varied from 28 to 87.5 per cent. The lymphocytes varied from 4 to 20 per cent.

Attention was first called to the high percentage of eosinophiles in the blood of patients having trichinosis by the researches of W. S. Thayer and Thomas R. Brown,⁴ and it has proved of great diagnostic importance. This percentage was above 20 in thirty-one cases, or considerably more than half the series; it was above 40 in almost one-fourth of the cases, and the highest records were two cases giving 60 per cent., one 52, one 74, and two 81 per cent. In one of the latter the full blood picture was as follows:

Polynuclear cells	14
Large lymphocytes	1
Small lymphocytes	3
Large mononuclear	1
Eosinophiles	81
	<hr/>
	100

In another case, with phenomenally high eosinophilia the blood picture showed:

Polynuclear cells	28.6
Transitional cells	0.0
Large mononuclear cells	0.0
Lymphocytes	11.4
Basophiles	0.0
Eosinophiles	60.0
	<hr/>
	100.0

In another case there were 28,750 leukocytes, with the following differential count:

Polynuclear cells	16.5
Lymphocytes	5.5
Transitional	4.0
Eosinophiles	74.0
	<hr/>
	100.0

In repeated examinations in this case the eosinophiles rose in number as the leukocytosis declined. C. Stauble noticed this rela-

⁴ *Lancet*, 1897, and *Jour. Exper. Med.*, 1898, No. 3,

tionship in experimental trichinosis in animals. In an experimental research in guinea-pigs, this author⁵ produced eosinophilia of 52 per cent. with artificially induced trichinosis, and Kerr⁶ reported a case in a man with 86 per cent. of eosinophiles. T. H. Dexter⁷ reported cases with eosinophilia up to 68 per cent. H. Albert and H. W. Norris⁸ reported a case of trichinosis with an eosinophilia of 72 per cent. J. L. Hirsch⁹ reported a house endemic of five cases of trichinosis in one family from eating raw ham. In one of these cases there was 45 per cent. of eosinophilies, and in none was the eosinophilia definitely related to the severity of the symptoms. In one of the five cases of trichinosis reported by Thomas R. Brown¹⁰ the eosinophilia reached 50 per cent., and in another, 49 per cent. The eosinophilia sometimes presented considerable fluctuation during the progress of the disease. Thus, in one case of my series the count fell from 33 per cent. to 7.5 and rose again to 12 per cent. The eosinophilia affords no accurate index of the severity of the symptoms, either as to fever, muscle pains, or otherwise. For example, in one case the eosinophilia was 74 per cent., while the temperature was only 102° F.

One of the most protracted and serious of my cases gave the following blood count (made by Thomas W. Hastings): Leukocytes, total, 10,000; polynuclear cells, 70 per cent.; lymphocytes, 20 per cent.; eosinophiles, 12 per cent. At this time the patient's temperature was 105° F. While he was convalescing, with normal temperature, and no pain or tenderness, the eosinophilia rose to 62 per cent. In another case the eosinophiles numbered only 28 per cent., while the temperature was 105° F. In one case the eosinophiles numbered only 3 per cent. at the time when trichinae were obtained from the gastrocnemius, although they had previously numbered 10 per cent. at the onset and 24 per cent. subsequently.

In another case the eosinophilia, which was 30 per cent., while the temperature was 104° F., rose to 52 per cent. after the temperature had been normal for ten days. As the eosinophiles accumulate around the encysted trichinae their percentage may vary with the site from which blood is obtained for examination. For example, in one case blood from the infected muscle area gave 59 per cent., but that from the ear lobe (which was not tender) yielded only 33 per cent. I have been unable to obtain data as to the duration of the eosinophilia after recovery, for the patients usually being well, pass from observation, but one man went home in good health still showing 62 per cent. of eosinophiles, and K. Schleip reported 45.2 per cent. in a convalescent.

⁵ "Trichinosis," Weisbaden, 1909.

⁶ Phila. Med. Jour., August 25, 1900.

⁷ New York State Jour. Med., March, 1910, vol. x, No. 3.

⁸ Jour. Amer. Med. Assoc., November 21, 1908.

⁹ Med. News, January 7, 1899.

¹⁰ Ibid., January 15, 1910.

Various theories have been advanced regarding the function of eosinophilia. Bazzicalupo¹¹ discusses the connection between eosinophiles and antibodies in the serum, with the conclusion that they bear a direct relation to the presence of toxins in the blood, being in inverse relationship to the production of antibodies. There are, however, so few diseases of pronounced toxemia in which eosinophiles are notably increased, that their role cannot be very important. They have been found increased under the following conditions (1 to 4 per cent. being normal in adults):

1. In pneumonia, just before the crisis, exceptionally, 5 or 6 per cent.

2. In a few skin diseases of wide distribution, such as dermatitis exfoliativa, pemphigus, psoriasis, prurigo, general eczema, such bulbous eruptions as dermatitis herpetiformis, and in leprosy, in all of which they rarely reach 10 or 12 per cent., and do not long remain at that ratio. James C. Johnston and Hans J. Schwarz report from the Cornell University Medical College Clinic¹² a case of dermatitis herpetiformis with eosinophilia of 9.6 per cent., and one of prurigo of Hebra, with 21 per cent., subsequently falling to 2.6 per cent. No mention is made, however, of the exclusion of possible intestinal parasites as a complication, and in another of their cases of prurigo, the eosinophilia was only 3 per cent. In trichinosis, however, the eosinophilia is not only *invariably* present, but usually in high degree, and remains long. Thomas R. Brown found 24 per cent. of eosinophiles in a case of chronic eczema, and John W. Coe¹³ found 51.8 per cent. in a case of pemphigus, 21 per cent. in one of psoriasis, 20 per cent. in one of dermatitis herpetiformis, and 18 per cent. in one of psoriasis. In all such exceptional cases, however, the diagnosis is, of course, obvious from the presence of the cutaneous lesion, but care should be exercised to exclude the possible coexistence of intestinal parasites of some kind. Moreover, in cutaneous cases of equal severity, eosinophilia is by no means constant. For example, in a second case of pemphigus studied by Coe, it was absent.

3. With intestinal parasites (other than trichina spiralis). The eosinophilia accompanying uncinariasis, round worms, tapeworms of various species, and other intestinal parasites, is rarely very high, and never so high as in most cases of trichinosis. I have seen it 2.3 per cent. with tenia saginata, and only 1.5 per cent. with ascaris.

4. In bronchial asthma. In an obstinate case of bronchial asthma which I have lately observed in a girl, aged twenty years, the eosinophilia during a paroxysm reached 12 per cent. Repeated examination of the stools failed to reveal evidence of any form of intestinal parasite, and trichinosis was positively excluded. Thomas R. Brown cites a case of bronchial asthma with an eosinophilia of 22.4 per cent.

¹¹ Gaz. degli Ospedale, Milan, xxix, No. 35.

¹² New York Med. Jour., March, 1909.

¹³ Presbyterian Hospital Reports, New York, 1904.

Ira S. Wile,¹⁴ in a general study of eosinophilia, says that a moderate increase in eosinophiles may be produced exceptionally by such drugs as camphor, potassium iodide, and sodium salicylate, but I have never observed it even when large doses of these drugs were being administered. He also claims that improvement in tuberculosis is accompanied by eosinophilic increase.

Microscopic examination of sections of muscle were made in various cases from such muscles as the deltoid, biceps, and gastrocnemius.

In twenty-nine cases trichinæ were found, and in five more an acute myositis was present. In the remaining eighteen cases either no examination was made, or no trichinæ were found in the specimen isolated, but in all these cases the other symptoms, such as a high degree of eosinophilia, puffiness of the eyes, dyspnoea, fever and generalized muscular pains and soreness justified the diagnosis, especially as such cases frequently occurred in connection with one or two others, in which the trichinæ were found—that is, among patients simultaneously exposed to infection.

In one case the fragment of biceps muscle examined by Dr. Meakins, of the Pathological Department of the Presbyterian Hospital, showed the encapsulated spirillæ lying between the muscle fibers, each surrounded by a zone of eosinophiles. In two cases small round-cell infiltration of the muscle was recorded, and in another there was infiltration with round and polygonal cells together with eosinophiles. Another case presented between the muscle fibers minute cysts with dense granular contents.

The temperature rise is one of the most interesting symptoms. It is fairly acute and varies from a few days to several weeks in duration—in the longest case of the series ten weeks, in the shortest, three days. In the ordinarily severe cases it remains at a maximum of 104° F. to 104.5° F. for four to five days, when it declines gradually, with daily fluctuations of about three degrees F.

The subsidence is always by lysis. In average cases the temperature consumes from ten to sixteen days in falling from 104° F. to normal, but not infrequently, after falling to 100° F. or 101° F., it remains constant at that low level for many weeks. In one case a temperature between 100° F. and 105° F. lasted ten weeks. In another case the temperature ranged between 101° F. and 100° F. for forty days, and a large number exhibited more or less fever for six weeks. In twenty cases of the series the temperature passed the 104° F. record, in three it was 105° F., and in two, 105.5° F. In more than half of all the cases it rose considerably above 102° F. Despite the high and often protracted fever, the patients usually appear much less ill than with similar grades of fever due to other causes, and are rarely delirious. One of my patients presented a tempera-

¹⁴ Med. Record, January 29, 1910.

ture of 105.5° F., an eosinophilia of 62 per cent., and trichinæ in the muscle fragments removed, yet the man had comparatively little muscle soreness throughout, and felt so well at the height of the fever that it was with difficulty he was persuaded to remain in bed.

In a few cases—four or five—after an interval of three or four weeks of apparent recovery, there was a return of symptoms, and in several there was a decided exacerbation of temperature and other symptoms after their partial decline. As a rule, however, improvement once begun, progresses uninterruptedly, although very slowly.

The nationality of the patients included a wide range. The majority naturally, from their dietetic habits, were foreigners, such especially as natives of Hungary, Poland, Norway, Bohemia, Germany, Austria, and Italy, but not a few were Americans. Six of the private patients whom I have seen were Americans in good social position, victims of infected sausage and potted ham. The previous diet of those patients who could give an intelligent account of it after the long intervening latent period had elapsed, included such foods as raw pork, raw ham, potted ham, imperfectly smoked ham, head cheese, and a variety of sausages.

Albert and Norris, in the article above cited, report an endemic of fourteen cases of trichinosis occurring in 1908 in Grinnell, Iowa, from eating imperfectly boiled ham.

The disease, as met with in this country, is rarely fatal, although the patients may become very seriously ill. There were only two deaths among the entire series of cases presented. One of these occurred in a Pole in my service, who had only 5 per cent. of eosinophiles, while trichinæ were discovered in the deltoid. He acquired erysipelas and pneumonia, which, rather than the trichinosis, were the cause of death. The other patient, the only one in whom the disease may rightly be said to have been the cause of death, died in delirium with respirations of 60, a pulse of 132, dry tongue, and high fever. In this case the maximum eosinophilia was 14.5 per cent.

That the eosinophilia of trichinosis, which is unique in its excess is due to some specific toxin generated through the agency of the parasite, might be argued from the fact that in acute or subacute polymyositis, unattended by trichinosis, it is absent; hence it is not the polymyositis alone which causes it. In one case of this type which I recently observed, and in which trichinosis was definitely excluded, there was no eosinophilia, and in three cases reported by Benjamin T. Burley¹⁵ he had the same experience. On the other hand, if the hypothesis be correct that a specific toxin caused by the agency of the parasite is responsible for the aggregation of eosinophiles, which occurs around the organisms in between the muscle fibers, one would naturally expect the eosinophilia of the blood to be at its maximum before the parasites became encysted and quies-

¹⁵ Jour. Amer. Med. Assoc., January 18, 1908; see also AMER. JOUR. MED. SCI., this issue, p. 167.

cent; yet in many of the cases herein recorded, such was not the fact, notably in that of the patient whose maximum eosinophilia of 62 per cent. was not reached until more than six weeks after his first symptoms appeared, when he was practically well. It is difficult to understand how in such a case the eosinophilic response can be in any sense protective. Moreover, the eosinophilia is entirely independent of definite relationship to either the general leukocytosis or the course of the fever. The question is obscure and experimental evidence is much needed to elucidate it. Some of the tapeworms, notably *Dibothriocephalus latus* are known to generate specific toxins causing anemia, yet their eosinophilic response is much less than that of trichinosis. In a case of this sort which I have elsewhere reported,¹⁶ the eosinophilia never exceeded 9 per cent., although a condition of pernicious anemia was produced, of extraordinary degree.

Von Leube¹⁷ states that it is impossible to distinguish polymyositis from trichinosis in many cases without examination of excised muscle, and Hepp,¹⁸ in an early account of polymyositis, referred to it as "Pseudo-trichinose," but in the light of recent study the diagnosis ought not to be so difficult even without excision of muscle, for in polymyositis eosinophilia is lacking, as well as the eye pains, marked headache, puffiness of the eyelids, vomiting and peculiar dyspnoea, which characterize all the more severe cases of trichinosis. Apart from polymyositis, those diseases for which trichinosis is most often mistaken are typhoid fever, paratyphoid fever, septicemia, acute rheumatic fever, estivo-autumnal fever, multiple neuritis, and acute poliomyelitis.

The temperature charts of cases of trichinosis very often closely resemble typical charts of typhoid fever in the third and fourth week, and the headache and occasional epistaxis may be confusing, but in trichinosis the patient is usually proportionately less ill and lacks the nervous phenomena of typhoid fever. Moreover, the onset of trichinosis is more acute, with vomiting and muscular pains and cramps. The two diseases may, however, co-exist, as they did in the original case of Zenker, which led him to discover the trichinae in a routine examination for degenerated muscle fibers in a patient who had died from typhoid fever. Fischer¹⁹ and MacCrae²⁰ have each reported a case of combined trichinosis and typhoid infection.

Exceptionally, the trichinosis charts may resemble the markedly remittent temperature curve of septicemia or of a estivo-autumnal fever with chills and sweats, but a thorough examination of the blood in all such cases ought to resolve all doubt.

Occasionally, in trichinosis there is swelling about such major joints as the knees and ankles, and this, with the pain caused by

¹⁶ Med. News, April 8, 1905.

¹⁸ Berl. klin. Woch., 1887, xxiv, 297-322.

²⁰ AMER. JOUR. MED. SCI., 1902, cxxiv, 56.

¹⁷ Medical Diagnosis.

¹⁹ Deut. med. Woch., 1898, xxiv, 821.

voluntary movement and sweating, may give rise to an erroneous diagnosis of rheumatism. I have lately seen a case which had been mistaken for rheumatism for a week, owing to such symptoms, and the fact that the patient a year before had had a typical acute articular rheumatism. The hemorrhages into the cornea led me to suspect the presence of trichinosis, and the latter diagnosis was confirmed by finding eosinophilia and the presence of trichinæ in an excised fragment of the gastrocnemius.

I saw another interesting case in a lad, aged eighteen years, in which a diagnosis of rheumatism similiary had first been made, for which that of acute poliomyelitis had later been substituted by the physicians in attendance. The latter diagnosis was held because of a recent epidemic of poliomyelitis occurring in the same locality, and the patient suffered such excruciating pains in the extremities that lack of motion was mistaken for paralysis. Having demonstrated that paralysis did not exist, I suspected trichinosis from the slight puffiness of the eyelids and a diaphragmatic type of dyspnœa. I obtained a blood examination as follows:

Hemoglobin	85 per cent.	
Erythrocytes	5,032,000	
Leukocytes	24,300	
Polynuclear cells		76.5
Transitional		0.9
Lymphocytes		7.4
Eosinophiles		15.2
		<hr/> 100.0

I found that the patient had eaten poorly cooked "Bolognas" two weeks prior to his illness, and a similar milder case was found in the cook who had partaken of the same food.

To recapitulate: There should be no difficulty in determining promptly a correct diagnosis of trichinosis based upon the observation of the following symptoms:

1. Acute onset usually with vomiting and abdominal cramps.
2. A high grade of eosinophilia, invariably present; usually above 30 per cent., and frequently much higher—even above 80 per cent.
3. A high grade of temperature, often reaching 104° or more, and lasting, in lessening degree, for two to six weeks.
4. Puffiness of the eyelids and face, with pains in the eyes occurring in one-fourth of the cases.
5. Dyspnœa and diaphragmatic breathing occurring without cyanosis in about one-fourth of the cases.
6. The generalized muscle pains, cramps, soreness, and prostration, causing sometimes deceptive apparent immobility.
7. The sudden occurrence of symmetrical circumscribed corneal hemorrhages in a patient whose bloodvessels are not degenerated, should give rise to a suspicion of trichinosis.

AN EPIDEMIC (FOURTEEN CASES) OF TRICHINOSIS, DUE TO EATING BOILED HAM, WITH SPECIAL REFERENCE TO THE OCCURRENCE OF EOSINOPHILIA.

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HISTORY OF THE EPIDEMIC. During the month of October, 1907, an outbreak of trichinosis affecting fourteen persons occurred at Grinnell, Iowa. Thirteen of these were students at Iowa College, located in that city. The infection occurred from eating boiled ham in one of the clubs and at one of the restaurants. The ham in all cases was obtained from the same packing house, and represented meat which had been inspected. Ten of the cases occurred among the students at one boarding club, three were young women students who, in company with three others, partook of ham sandwiches at a local restaurant, and one was a young man (not a student) who obtained ham at the same place. Most of the cases were diagnosed as trichinosis very soon after the beginning of the symptoms. The occurrence of so many cases among the members of the boarding house, the eating of boiled ham, the finding of trichinæ in the ham, together with the rather characteristic symptoms, made the diagnosis comparatively easy. Some of the cases were considered as typhoid fever, one as rheumatism, and one as a disease of the eyes, until the diagnosis became very evident, as determined by an examination of the blood. In no case was a positive Widal reaction obtained. The accompanying tabulation presents the important data of most of the cases.

A study of the epidemic reveals two features of special significance—the thermal death point of trichinæ and the value of eosinophilia in the diagnosis of trichinosis.

THE THERMAL DEATH POINT OF TRICHINA. The epidemic of trichinosis in question resulted from the eating of boiled ham. It is well known that the majority of cases result from the eating of uncooked seasoned or smoked pork or sausage, and we have been unable to find in the literature any instances of cases of trichinosis being traced to the eating of our popular boiled ham.

On making inquiry of several of our largest packing houses in regard to the length of time that their ham was boiled, we received from one the following answer: "When cooking boiled hams, we keep the temperature of the water about 190° to 200° F. for an hour; then permit the temperature to run down gradually to about 155° to 160° F. when the cooking is finished. Our rule is to cook the hams thirty-eight minutes per pound of weight—that is, a ten-pound ham would be cooked about six and one-half hours." Another wrote as follows: "We believe that the temperature of 170° F.

TABLE OF THE GRINNELL EPIDEMIC OF TRICHINOSIS.

Case.	Age.	Sex.	Source.	Date of infection.	Date of beginning of illness.	Time between infection and first symptoms.	Symptoms (general).	Ultimate recovery (slow or rapid).	Duration of severe part of illness.	Symptoms Nov. 25, 1907.	Clinical diagnosis.	Blood examinations.						
												Date.	Number of leukocytes.	Per cent. eosinophiles.	Per cent. polymorpho-nuclear neutrophiles.	Lymphocytes.	Basophiles.	Widal reaction for typhoid.
1. H. L. B.	20 M.		Boiled ham at club	Oct. 6, 1907	Oct. 18, 1907	12 days	Sore and stiff on rising in morning as with a cold. Muscles of neck, arm, shoulder, calf of leg sore, lame. Terrible aching in small of back. Much constipated.	Rapid	10 days	None.	Trichinosis.	Oct. 28, 1907 Nov. 21, 1907 Dec. 18, 1907 Jan. 22, 1908	9,000 8,200 7,300 8,000	72 24 16 6	16 42 62 72	12 32 22 22	2	—
2. O. C.	21 M.		Boiled ham at club	Oct. 6, 1907	Oct. 10, 1907	4 days	Diarrhea, followed a week later with calves sore and lameness. No lasting effects.	Rapid	10 days	Rather weak.	Typhoid, later trichinosis.	Nov. 9, 1907	8,000	24	59	16	1	—
3. H.	21 M.		Boiled ham at club	Oct. 6, 1907	Oct. 15, 1907	9 days	Symptoms suggestive of typhoid fever.	Rapid	10 days	"Feel bum."	Trichinosis.	Nov. 5, 1907	14,000	4	76	20	—	—
4. J. L.	23 M.		Hinn sandwich at restaurant	About Oct. 5, 1907	Oct. 20, 1907	15 days	Sick at stomach; constipated; muscles weak.	Slow	....			Nov. 21, 1907	5,400	22	51	27	—	—
5. Ma.	20 M.		Boiled ham at club	Oct. 6, 1907	Oct. 15, 1907	9 days	Swelling of eyes, sore diaphragm. Treated for eye trouble.	Rapid	....	About well.	Eye troubles (one physician); trichinosis (another physician).	Nov. 1, 1907	5,400	22	51	27	—	—
6. R. M.	23 M.		Boiled ham at club	Oct. 6, 1907	Oct. 13, 1907	7 days	Diagnosed as typhoid; fever ran up to 103°, lasted 10 days. Treated first for eyes, which were swollen. Constipated. Aching in muscles, especially in thighs. Four weeks after first had apparently a second attack.	Slow	10 days	Weak, muscular work makes muscles sore. Drooped out of college.	Typhoid (one physician); trichinosis (another physician).	Nov. 5, 1907 Nov. 11, 1907 Nov. 26, 1907	12,000 6,000 6,000	55 40 18	24 36 60	21 24 22	—	—
7. Mur.	20 M.		Boiled ham at club	Oct. 6, 1907	Oct. 16, 1907	10 days	Soreness in muscles and diaphragm. Constipated.	Rapid	3 to 4 days	.....	Trichinosis.	Nov. 27, 1907	6,900	24	50	24	2	—
8. R.	20 M.		Boiled ham at club	Oct. 6, 1907	Oct. 15, 1907	9 days	Swelling of eyes; soreness in back, neck and side. Constipated. In bed with fever 11 days. Temperature, 100.5° to 102°.	Rapid	14 days	Almost none.	Trichinosis.	Nov. 7, 1907 Nov. 26, 1907	9,600 12,000	10 16	70 60	20 24	—	—
9. S.	21 M.		Boiled ham at club	Oct. 6, 1907	Oct. 15, 1907	9 days	Eyes swollen shut. Muscles of calves and shoulders sore and aching, could hardly walk. Constipated.	Slow	14 days	"Rheumatic"	Trichinosis.	Nov. 27, 1907	9,200	12	52	32	4	—
10. T.	20 M.		Boiled ham at club	Oct. 6, 1907	Oct. 15, 1907	9 days	Soreness and aching of muscles, especially back of neck; eyes swollen. Much constipated.	Rapid	14 days	Soreness of muscles until Nov. 20.	Trichinosis.	Nov. 27, 1907	8,600	12	58	30	—	—
11. M.	20 F.		Ham sandwich at restaurant	Oct. 4, 1907	Oct. 15, 1907	11 days	"Terrible aching."	Slow	5 to 6 days	Run down—dropped work.	Trichinosis.	Oct. 29, 1907 Nov. 5, 1907 Dec. 18, 1907 Jan. 22, 1908	11,000 9,000 8,800 7,400	18 12 6 4	56 64 66 60	26 24 28 32	—	—

destroys the effectiveness of any trichinosis germs. We always see to it that this temperature and higher is reached in our ham boiling vats. It is to the short sighted financial interest of one who is boiling hams for the market to cook to the minimum amount, in order to avoid shrinkage in weight." From a third we learned the following: "Our hams are boiled at various temperatures, according to size, and the demand of the trade in different territories. I should say that the average temperature is between 200° and 212° F."

Just what temperature was used for boiling the ham which was the cause of the outbreak that I report it has been impossible to learn, the firm from whom it was obtained stating that their hams are boiled at various temperatures, according to the size of the piece and the demand of the trade. They state, however, that the average temperature is between 200° and 212° F.

"On page 211 of Ainsworth Mitchell's book on *Flesh Food*, the statement is made that trichinæ perish above a temperature of 69° C., or 140° F." On the other hand, the statement is made by Beecher¹ that a temperature of 180° F. will not always kill trichinæ. It is very improbable that boiled ham is at all a common source of trichinæ infection. If it were, cases would be far more frequent than they are. That it may occur, however, is evident from the history of our epidemic. It is probable also that many of the isolated cases of trichinosis, especially of the milder types, go unrecognized as such. It appears evident that we are not yet absolutely certain as to just what temperature, maintained for what length of time, and varying to what degree with the size of the piece, should be attained in order to be absolutely certain that all trichinæ have been killed. There is little doubt but that it will depend somewhat upon the degree of encapsulation of the embryonic forms and the nature of the capsule, whether it is simply a fibrous one or whether it has become calcareous. This is a subject which would be well worth investigation, inasmuch as it has been estimated that about 2 per cent. of hogs are infected with trichinæ, and inasmuch as our Government no longer inspects meat for home consumption for the presence of these parasites. Cooking seems to be the only effective prophylactic measure against trichinæ infection. Thorough salting and hot smoking also generally kill the parasites. They have been found alive in pickled meat for fifteen months, and have been known to resist freezing for two months.

THE VALUE OF EOSINOPHILIA IN THE DIAGNOSIS OF TRICHINOSIS. It is not the purpose of this article to refer in detail to the diagnosis and differential diagnosis of trichinæ infection. Suffice it to say, that many cases of trichinosis have gone unrecognized—some of the cases being diagnosed as typhoid fever, others as muscular rheu-

¹ Jour. Amer. Med. Assoc., 1906, xlvii, 1677.

matism, and still others as obscure conditions. H. U. Williams² found trichinæ in twenty-seven, or 5.3 per cent., of 505 unselected autopsies in which the death of the patient was due to some condition other than trichinosis. According to statistics collected by C. W. Stiles, there were reported in the United States, up to 1893, a total of 709 cases of trichinosis, of which 129 were reported from New York, 119 from Illinois, 115 from Massachusetts, 108 from Iowa, etc. Comparing these figures with the autopsy findings just mentioned, and a personal experience in connection with the investigation of thirty-two cases of trichinosis in Iowa during the past five years, makes it very evident that the figures are far from representing the actual number of cases that have occurred. Packard³ reviewed the cases of trichinosis reported in the United States up to 1897.

During the acute attack the clinical symptoms are not always sufficiently distinct to enable a positive diagnosis to be made. The search for the parasite in the feces does not always give positive results. The examination of a piece of the affected muscle for the embryonic worms is often unsatisfactory—since, in the first place, the consent cannot always be secured for obtaining a piece of the muscle; and, in the second place, parasites are by no means always found, even in cases in which they exist. The occurrence of the eosinophilia, therefore, has become of more practical value in the diagnosis of this disease. The blood should be examined during the second and third week after infection, for it is then that the eosinophilia is usually at its highest. It is true that eosinophilia may occur in connection with other disease processes. It none, however, does it, as a rule, attain such heights as in trichinosis, nor does it occur in any conditions which are liable to be confused with infection with this parasite. The conditions in which it has been found especially are as follows:

1. Bronchial asthma in which the percentage of eosinophilia during and immediately following the paroxysms may be as high as 25 per cent.

2. In many infections of the skin, especially pemphigus, psoriasis, and other chronic conditions. In these an eosinophilia of 10 to 17 per cent. has been noticed.

3. Diseases of the bones are sometimes associated with a mild eosinophilia. Thus, the occurrence of an eosinophilia during the course of sarcoma suggests a secondary involvement of osseous tissue.

4. Intestinal parasites. Eosinophilia has been observed in connection with infection with uncinaria, oxyuris, ascaris, and the

² Trichinosis, Jour. Med. Res., July, 1901, Jour. Amer. Med. Assoc., September 28, 1901, p. 863

³ On the Increase of the Eosinophilic Cells in the Circulating Blood in Trichinosis, Lancet, 1897, ii, 787.

tenia. The eosinophilia in these conditions may vary from ten to twenty, or, in rare cases, even a higher percentage.

5. *Trichina* infection. It is in this condition that we find the most constant and altogether most marked eosinophilia. It begins as a rule, about the ninth to the twelfth day after infection, rising rapidly from the normal 2 to 4 per cent. to 35 to 50 per cent., and is at its height, as a rule, about three weeks after infection. The eosinophilia, therefore, is found to correspond to the time when the embryonic forms of the worm are migrating from the intestine and becoming localized in the muscle. The origin of the eosinophile cells and the cause of the eosinophilia has been a matter of some dispute and will be considered while reviewing the literature on the subject.

Thomas R. Brown,⁴ was the first to call attention to the large percentage of eosinophiles found in the blood in trichinosis. His report appeared in April, 1897, Thayer⁵ and Cabot⁶ later, in 1897, also reported the finding of eosinophile cells in the circulating blood in trichinosis. In 1898 Brown again reported his finding of eosinophilia, describing two cases observed in the medical clinic of Johns Hopkins Hospital, at Baltimore. At the time of entrance the percentage of eosinophilia was 37. In one case the percentage reached 68.2. The three conditions to which Brown especially called attention are the marked eosinophilia, marked leukocytosis, and a reduction in the number of neutrophiles. Brown at first believed that in this disease the neutrophiles were transformed into eosinophiles in the muscle. He based this belief principally on the fact that when he first examined the muscle he found transition stages between neutrophiles and eosinophiles; whereas, when he examined it two weeks later, there was a marked increase of the eosinophile cells. His theory to explain the transition was that the local inflammation set up by the embryos entering the muscle cells caused a marked migration of the leukocytes to such areas. By virtue of their phagocytic activity they ingest bits of degenerated muscle tissue, which Brown believed changed the chemical composition of the cell and caused the transformation of the neutrophile into eosinophile granules. These cells then wandering back into the blood stream accounts for the marked eosinophilia. According to a more recent (1902) report by Brown, he leans favorably to the well-known theory

⁴ Studies on Trichinosis, with Especial Reference to the Increase of the Eosinophilic Cells and Their Diagnostic Importance, Jour. Exper. Med., 1898, iii, 315-347; A Note on the Duration of Eosinophilia in Trichinosis, Boston Med. and Surg. Jour., 1898, cxxxix, 218; The Diagnosis of Trichinosis by Means of the Great Increase of the Eosinophiles in the Blood, Report of Fourth Case, Med. News, 1899, lxxiv, 12; The Origin of Eosinophile Cells and their Diagnostic and Prognostic Importance, Med. News, 1903, lxxxii, 1117; The Eosinophiles, Their Etiology, and Their Clinical Significance, Trans. Med. Soc. New York, Albany, 1903, 139.; Studies of Trichinosis, Johns Hopkins Hosp. Bull., 1897, viii, 79-81.

⁵ A third Case of Trichinosis with Remarkable Increase in the Eosinophilic Cells, Phila. Med. Jour., 1898, i, 654; On the Increase of the Eosinophilic Cells in the Circulating Blood in Trichinosis, Lancet, 1897, ii, 787.

⁶ Boston Med. and Surg. Jour., cxxvii, 676.

of Ehrlich, according to which the eosinophile cells of the blood are derived from the eosinophile cells of the bone marrow, their appearance in the blood being due to some chemotactic influence. He still, however, holds to his original belief that some of the eosinophile cells are developed at the site of the lesion.

Atkinson⁷ described a case in 1899 in which a diagnosis of trichinosis was based on the oedema, together with a marked leukocytosis and an eosinophilia of 50 per cent. In his case the eosinophilia gradually decreased as the symptoms subsided. The diagnosis was verified by the finding of a few non-encapsulated trichinæ in a section of a muscle.

In June, 1901, Da Costa⁸ reported a case of a man who developed pain in the calf of the right leg. An operation was performed and a piece of the muscle removed. This, on examination, was found to contain a large number of trichinæ. A blood examination was then made; a leukocyte count of 17,600 was found, 3 per cent. of which were eosinophiles. The blood examination was made about a year after the pain, and it does not, therefore, indicate whether or not eosinophilia ever existed. The disease was limited to the part mentioned, and the diagnosis was not made until microscopic sections were examined.

Schleip⁹ gives an interesting description of an epidemic of trichinosis which occurred in Homberg, in September, 1903. In all, 130 persons were affected. The diagnosis was made very soon after the appearance of the disease. He made a blood examination of some of his cases, all of which revealed an eosinophilia.

Early in 1904 Opie¹⁰ performed experiments by feeding guinea-pigs with *Trichinæ spiralis*, and found a marked increase in the number of eosinophiles in the blood. He did not find any constant alteration in the number of cells until about the end of the second week after infection, when their relative and absolute number increased rapidly, reaching the maximum at the middle of the third week. This marked increase in the number of eosinophiles corresponds with the time when the embryonic trichinæ are being transmitted from the intestine to the muscles by way of the lymph and blood streams. He found an accumulation of eosinophiles in the mesenteric lymph glands. He also noticed characteristic changes in the bone marrow; the fat was gradually replaced with cellular elements and the number of eosinophiles was enormously increased, especially the eosinophilic myelocytes. Opie noticed that pork with 2000 to 3000 trichinæ failed to produce death of a

⁷ Diagnosis of Trichinosis Made through Increase of Eosinophilic Cells in Blood. Phila. Med. Jour., June 3, 1899.

⁸ Jour. Amer. Med. Assoc., 1901, xxvi, 1729.

⁹ Die Homberger Trichinosis Epidemie und die für Trichinosis pathognomonische Eosinophilie, Deut. Arch. f. klin. Med., 1904, lxxx, 1.

¹⁰ Experimental Study of the Relation of Cells with Eosinophile Granulation to Infection with an Animal Parasite (*Trichina spiralis*), AMER. JOUR. MED. SCI., March, 1904.

guinea-pig, or did so only after several weeks. A larger dose is usually fatal in from one to two weeks. In all cases he noticed that there was a marked diminution in the number of eosinophiles some time before death, and that in severe infections no eosinophilia whatever appeared. In this connection it may be of interest to notice that Williams and Bentz did not find any noteworthy increase of eosinophile cells in the blood of rats and cats artificially infected with trichinæ; on the other hand, Fox, working in the Histological Laboratory of the University of Iowa, noticed not only an eosinophilia of the blood, but also the characteristic change noted above, in the bone marrow in two cats which had been fed on the refuse of a slaughter house.

Straubli¹¹ reports seven cases, four of which terminated fatally. He notes that the eosinophiles begin to appear about nine days after the ingestion of the infected meat. In the cases which terminated fatally he found Kernig's sign present, and knee-jerks absent. In all of his cases the diazo reaction was pronounced—a point of special interest, because of the possibility of mistaking trichinosis for typhoid fever. He performed experiments on rabbits. In these he found a large number of the embryos in the heart's blood. His experiments confirmed his previous assumption, based on his clinical cases, that a rapid destruction of lymphocytes is a bad sign. He regards the eosinophilia as a reaction on the part of the organism to substances given off by the embryos or the degenerated muscle tissue. He found no local increase of eosinophiles in the muscles invaded by the parasites.

CONCLUSIONS. 1. Trichinosis is, no doubt, of far more frequent occurrence than is usually supposed. Many cases are no doubt diagnosed as cases of typhoid fever, rheumatism, ptomaine poisoning, cholera morbus, etc., or considered as obscure conditions.

2. Trichinosis usually results from the eating of uncooked seasoned or smoked pork or sausage, but may result from the eating of boiled ham which has not been exposed to a sufficient temperature for a sufficient length of time to kill all of the parasites.

3. A temperature of 170° to 200° F., maintained from one to six or more hours, depending upon the size of the ham, no doubt destroys the trichinæ in the vast majority of cases. Investigation made to determine exactly just what temperature maintained for what length of time is necessary to kill trichinæ should be made.

4. The severity of the case varies with the number and, no doubt, also the vitality of the parasites. In the outbreak which we reported, although the symptoms were in many cases quite severe, there were no deaths.

5. All pork consumed in any form other than boiled ham should have all parts raised to the boiling point.

¹¹ Klinische und experimentelle Untersuchungen über Trichinosis und über die Eosinophile im Allgemeinen, Deut. Arch., f. klin. Med., 1906. lxxxv.

6. The diagnosis of trichinosis occurring in isolated cases is frequently a matter of difficulty, and often can be greatly assisted by means of an examination of the blood.

7. So far as we know at the present time there is no condition in which the percentage of eosinophiles in the blood reaches such a high number so constantly as in trichinosis.

8. Eosinophilia occurs in practically every case of trichina infection. A few cases have been reported in which there was no eosinophilia (Da Costa, Howard, Rosenburger). Some of these were cases of severe infection, and in others an examination was made too long after the time of acute symptoms to be certain whether or not eosinophilia was or was not present at some time.

9. The eosinophilia of trichinosis varies, ordinarily, from 10 per cent. to 60 per cent. The highest percentage so far reported is 86 (Kerr).

10. Eosinophilia makes its appearance with the beginning of the acute muscular symptoms which represents about the seventh to twelfth day after infection. It is at its highest at the height of the acute muscular symptoms, which is, ordinarily, during the second or third week after infection. After this time it gradually disappears, so that at the end of the second or third month, there is usually no increase in the number of these cells.

11. The total leukocyte count is usually, but not invariably, increased in trichinæ infection. The number of neutrophiles is relatively, and sometimes absolutely, diminished during the period of eosinophilia.

In conclusion, I desire to express my thanks to Professor H. W. Norris, of Grinnell, for securing the clinical data and collecting specimens of blood; to the physicians of Grinnell, who furnished the clinical data, and to Dr. E. J. Ringena, of Deep River, who assisted in making the differential blood counts.

INTESTINAL DIVERTICULA.

A PATHOLOGICAL AND CLINICAL STUDY.

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THE condition known as diverticulum of the intestine has been recognized as a pathological entity for more than a hundred years, but knowledge of its relation to perforative peritonitis is of recent

date, and up to the present time few cases have been operated upon in which a pre-operative diagnosis was made. Cases, however, in which this condition proved to be the underlying cause of a peritoneal infection have multiplied of late, so that its complete analysis is a matter of interest, both to the scientific investigator and to the practical physician and surgeon.

The term diverticulum of the intestine may be applied to any outgrowth of the intestinal wall, not neoplastic in character, which has had at some time a lumen connecting it with the intestine, and whose walls are composed of structures similar to those found in the intestines. Under this definition, Meckel's diverticulum is included as a congenital anomaly, and the appendix vermiformis as a normal vestigial diverticulum. When the outgrowth is composed of all the structures which are found in the normal intestinal wall, it is called a true diverticulum. When some of these structures are absent, it is called a false diverticulum. That the former may become the latter, must be recognized.

The older classification into congenital and acquired diverticulum serves no useful purpose, and should be discarded, because with our present knowledge we can draw no distinguishing line between the two, except in the case of Meckel's diverticulum and the appendix; and we believe, as will develop later, that most, if not all, cases of diverticula have at least a congenital predisposition.

The structure of a diverticulum, when not inflamed, is very simple. If of the true variety, it is nothing other than the pouching out of the intestinal wall at some point. A section across the pouch shows the same coats arranged in the same way as in that part of the intestine of which it is an outgrowth. If of the false variety, the individual coats are more or less modified, and there is a practical absence of one or more of them, usually of the two muscular layers. In their early development, they are microscopical in size (Graser¹, Fischer²), and show at this time the characteristics of the true diverticulum. With their growth, however, the false characteristics come into evidence. If no inflammation supervenes, the structure remains unchanged during a considerable growth, so that the diverticula, varying in size from a buckshot to a hen's egg, may be seen presenting the simple structure above described. On the other hand, a varying amount of atrophy, particularly of the mucosa, may take place, and a hypertrophy of the submucosa and the subserosa. These changes are not, properly speaking, inflammatory, but are due to pressure. If no further alteration take place these diverticula do not give evidence of their presence by any clinical symptoms, in this respect resembling a Meckel's diverticulum and the appendix veriformis. If, on the

¹ Centralbl. f. Chir., 1898, xxv, Beil. 140; Verhandl. d. deutsch. Gesellsch. f. Chir., 1899, ii, 480; Verhandl. d. deutsch. path. Gesellsch., 1900, ii, 254; Münch. med. Woch., 1899, xlv, 721; Langenbeck's Archiv, 1899, lix, 638.

² Jour. Exper. Med., 1900-01, v, 333.

other hand, inflammatory changes do take place, there are present exactly the same factors for producing mischief as exist in the appendix and Meckel's pouch.

Until recent years it was believed that these diverticula are rare. Now, however, they are known to be common, and with this knowledge has come the further knowledge that they are the seat of great potential danger to health and life. In making a systematic search, Graser found 10 cases in 28 autopsies; Sudsuki³ found 15 in 40 autopsies; Stierlin (quoted by Verdenal⁴) found 10 in 38 autopsies. These were all in the lower colon or sigmoid. Baldwin⁵ has found 14 diverticula of the duodenum in a systematic search of 104 cadavers in the anatomical room of the Cornell Medical School. In 81 autopsies done at the Presbyterian Hospital, in New York City, from June, 1909, to February, 1910, 5 cases of sigmoid- and colon-diverticula are recorded, all of a well marked size.

Intestinal diverticula have been found in every portion of the alimentary tract, from the pylorus to the anal ring. The duodenum has furnished a large number (Baldwin); the whole small intestine has shown them; the appendix vermiformis itself has not escaped (Fischer Mertens⁶), and they have been found in large numbers in the colon and the sigmoid. The infection producing ischio-rectal abscess may find its way from the bowel through a diverticulum (Chiari⁷), though the latter is rare in the lower rectum. Apparently the sigmoid is the favorite site for their development. This may be accounted for by the fact that the secondary causes in their production, as elaborated later, are more potent here than in other parts of the bowel.

Their comparative absence in the rectum proper is interesting and is ascribed by Schreiber⁸ to the better musculature in this part. The total number found in one person may run high up in the hundreds. Structurally, they are the same no matter in what portion of the canal they are found, and there is no evidence that the etiological factors differ. In looking for their cause, therefore, we must accept only such conditions as are present along the whole intestinal tract, and such factors as do not conform to this condition must be excluded as primary causes.

A very large proportion of the diverticula of the small intestine occur either between the mesenteric leaves or close to them, (Fig. 1), and this fact led to the belief that there existed an inherent weakness here which was responsible for the hernial protrusion. The colon, however, often shows them placed laterally (Fig. 2). Herczel⁹ and Good¹⁰ showed that bulging of the intestinal wall first took place at the mesenteric border when the dead intestine was subjected to increased

³ Langenbeck's Archiv, 1900, lxi, 708.

⁴ Diss., Lyon, 1907.

⁵ Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1902, ix, 743.

⁶ Deutsch. Arch. f. klin. Med., 1902, lxxiv, 122.

¹⁰ Inaug. Diss., Zurich, 1894.

⁸ Personal communication.

⁹ Med. Jahrbücher, 1878, 419.

⁷ Beitr. z. klin. Chir., 1889, v, 690.

pressure within its lumen by distention with water. Hansemann¹¹ succeeded in producing actual diverticula. It was noted, however



FIG. 1.—Diverticula of the small intestine. The diverticula all occur along the mesenteric attachment. (Case XVIII.)

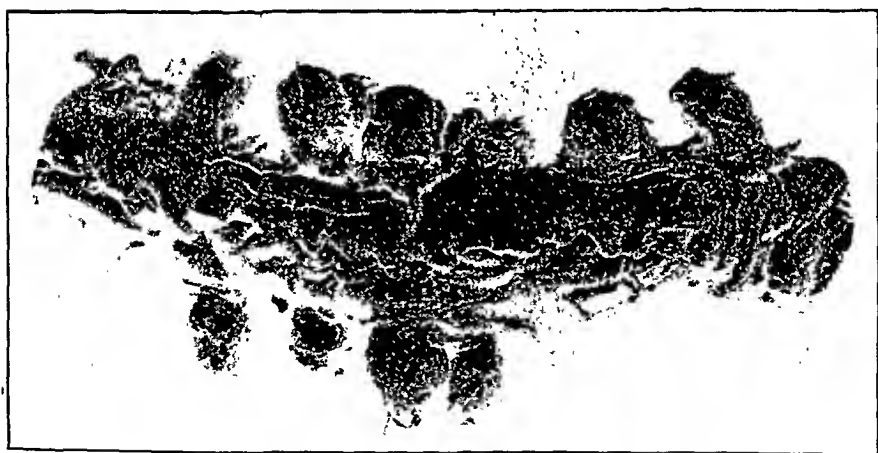


FIG. 2.—Diverticula of the colon. The diverticula lie between the lateral teniae and the mesenteric attachment. (Case XVII.)

that the weakness was present only in old persons, and not in children. Klebs, quoted by Beer in a study of diverticula, first noted

¹¹ Virchow's Archiv f. path. Anat., 1896 cxliv, 400.

that the protrusion bore a close relation to the bloodvessels entering and leaving the gut along the mesenteric attachment. This fact has been corroborated by every subsequent observer, and it was noted that the same relation held in the artificially produced bulgings.

These pathological and experimental findings were made the basis of a full explanation of the etiology of diverticula, as follows: The mesenteric border is weak; it is weakest at the point of entrance and exit of the vessels, particularly the latter; this weakness naturally increases with age; a comparatively moderate increase in internal pressure determines the giving away of the wall at one of these points, and the diverticulum is an accomplished fact. The constipation of the old was given as the cause of the increase in pressure. This explanation was complete for the condition as then understood. Further consideration, however, throws much doubt on it. Chlumsky¹² showed that no conclusions drawn from experiments on the dead gut were admissible as explaining facts existant in the living gut. He experimented with the normal intestine in the living dog, and with the intestine ten hours after death. In the former the rupture took place invariably opposite the mesentery, while in the latter, along the mesenteric border. Moreover, Philipowitz¹³ demonstrated that the dead intestine ruptured long before it had been distended to anything like the extent seen in the living subject in volvulus and other forms of obstruction. Beer¹⁴ quotes these findings and uses them as arguments against the supposed inherent weakness along the mesentery. He further calls attention to the fact that clinically, rupture of the intestine, from whatever cause, almost invariably occurs opposite the mesentery. He explains the difference in the results in the living and in the dead intestine as due in the first instance to the pressure of the blood stream filling the vessels and thus closing the spaces of entrance and exit, while in the latter, that is, the dead gut, the empty vessels leave a place of lessened resistance around them. He says: "The supposed weakness of the mesentery—in the living intestine—does not exist, and as it does not exist, it has nothing to do with the origin of acquired diverticula."

Graser investigated the subject most thoroughly as applied to diverticula occurring in the sigmoid. He found the same relation to the vessels as other observers; that is, the hernial protrusion follows the emerging vein and often takes a wandering course through the intestinal wall finally to reach the subserosa.

In this passage the circular muscular coat first gives way and the longitudinal follows later, or may only be thinned out. He then sought for the actual cause of the diverticulum and thought he found it in the presence of any obstructive lesion to the free return of blood through the inferior mesenteric vein, particularly where, as in

¹² Beiträge z. klin. Chir., 1899, xxv, 539.

¹³ Langenbeck's Arch., 1903, lxx, 679.

¹⁴ AMER. JOUR. MED. SCI., 1904, cxxviii, 135.

valvular heart lesions, the interference might be remittent. Under these conditions when the obstruction is marked the spaces through which the veins pass are dilated and the connective tissue and muscular bundles weakened. With the comparative collapse of the veins, when a free circulation is reëstablished, the spaces present a point of lowered resistance, and a gas or liquid pressure from within starts the development of the diverticulum. By a careful study of twenty-eight cases, from which he made over a thousand sections, in series, he believed he fully established this relation. He, however, pointed out the fact that the circulatory disturbance was only a predisposing cause, and that diverticula were not necessarily present in every case having such a disturbance.

Graser's view was opposed at the time he presented it, by Hansemann and others, and a year later Sudsuki made a study to prove its error. He examined, postmortem, twenty-eight sigmoids taken from patients who in life had suffered from interference with the venous return in the region of the inferior mesenteric vein, and found diverticula present in six of them. On the other hand, in twelve cases in which no evidence of such an interference existed, he found diverticula present nine times. He further showed that the size of the vein sheaths was independent of any obstructive lesion during life, the space often being distinctly larger when no such obstruction existed than it was in those cases in which it did exist. He concludes that Graser's findings were purely accidental, and that no causative relation exists between a circulatory disturbance and a diverticulum. He believed that the venous sheaths may be a point of weakness because of the thinning out of the connective tissue support in the subserosa and submucosa. This weakened point then gives way under the pressure of gas and feces, and the diverticulum results. Probably in the beginning it is of the true variety, but later the muscular coats give way, and it becomes false in character.

This explanation of the etiology may be accepted, in part at least, for those diverticula which are found near the mesentery where the veins are emerging, but, as Beer points out, it does not hold for those which occur on the convex side of the bowel. He, therefore, only accepts the weakening of the wall due to the passage of vessels through it as of secondary importance in a causative way. He offers the following explanation of the cause of diverticula: "There must be some change in the resistant powers of the gut wall. The fact that diverticula occur in old people, in people whose intestines have been more or less worked out, as evidenced by constipation, points to a muscular deficiency, and in this muscular weakness, the cause of the formation of false diverticula must be sought." . . . "It is very probable that the original view of Klebs is, in part, correct, especially with reference to the production of the diverticula in the small intestine, and that traction on the gut by the mesentery

is a factor in the production of the necessary weakness at this point, where these diverticula so regularly occur in the small intestine. That this traction is a reality can be easily demonstrated by distending loops of intestine *in situ*, or by noting the enormous tension of the mesentery in ileus cases. Naturally, in those parts of the intestine where no mesentery exists, this cannot be a factor."

That Beer's view is correct, so far as the pathological changes which lead to the diverticulum are concerned, we are willing to accept; but that he is incorrect in the primary cause of this change, namely, weakened musculature, due to age, is manifest from the fact that diverticula are found in children and young adults.

Ashhurst¹⁵ has reported a case in a boy of seven, and two of the cases reported in the present series occurred in children of seven and ten years, respectively (Figs. 3 and 4). A number were found in per-



FIG. 3.—Piece of colon obtained from a boy, aged six years. In one of the haustra, two diverticula can be seen, one on either side of the anterior tenia. (Case VII.)

sons under thirty. In none of these was there clinical evidence of deficient muscular activity of the intestine. The following observation, too, is of value in this connection. An examination of the colon from five infants who had died from various infantile diseases was made for the purpose of demonstrating the presence or absence of points of weakness in their walls. The colons were moderately hardened in formalin, and then filled with water just sufficient to render the walls taut, but not under enough pressure to stretch them. In three of the cases there was some evidence of a weakness at one or more points, while in two such evidence was absent. In

each of the positive cases there occurred a slight outpushing of the wall of the intestine, about 1 cm. in diameter, which had somewhat the macroscopic appearance of the small diverticula seen in adults. The wall over the fundus of the sac seemed to inspection and palpation distinctly thinner than in other parts of the gut. Microscopically, in sections taken transversely through the guts at the points described above, the muscularis appears definitely thinner than in the adjacent gut wall.

We, therefore, are driven to the conclusion that up to the present time no complete explanation of the primary cause of intestinal diverticula has been offered. The most that can be said is, that from some cause a weakness exists in the intestinal coats, and by reason of this weakness, a pouching of the coats takes place when any undue pressure arises. Conditions such as age, constipated

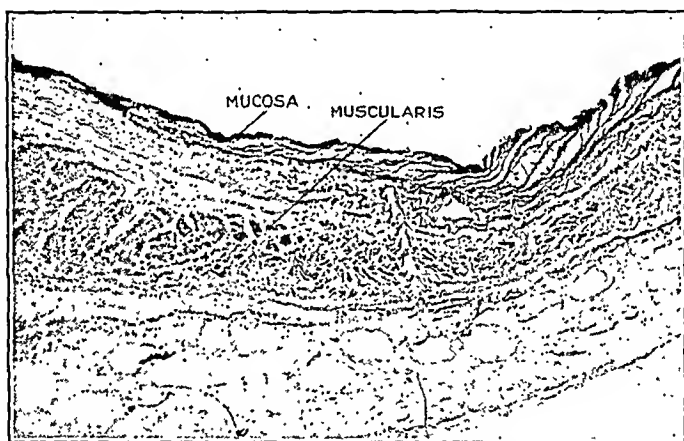


FIG. 4.—Microscopic section through a diverticulum in the sigmoid of a girl, aged ten years. The mucosa is flattened. The muscularis becomes thin and atrophic, almost disappearing over the fundus of the sac. (Case VIII.)

habit, excessive fat or emaciation, portal congestion, the anatomical weakness at the point of entrance or exit of vessels all play an undoubted role, but they are probably secondary to the inherent weakness above mentioned. Telling,¹⁶ in a very able discussion of the condition, based on a study of 105 cases, leaves the question of etiology unsettled. In speaking of this, he asks: "Are they always acquired?" and says: "In answer to this question, it is significant that no case has been reported in a child (Hale White, Schreiber)—(this we now see is incorrect)—while the great majority are in the old, even aged, subjects. Moreover, the various points which have been successively established with regard to their etiology would seem to put the answers to this question beyond doubt, even though we admit that a congenital anatomical arrangement of

¹⁶ *Lancet*, 1908, i, 843.

the muscle fibers, or of the connective tissue of the vessel spaces of the gut wall furnishes a special predisposition." "Whether this muscular weakness and thinning is a constant or frequent accompaniment, or whether it is a congenital or acquired condition, are points on which further research is needed."

It seems to us that great stress should be laid on the probability that a congenital defect in the musculature does exist, and that most diverticula occur because of this defect. Contrary to the expressed view, that young persons are not subject to them, as we have stated, there are many recorded cases in patients under thirty, and not a few in young children. Moreover, Edel,¹⁷ Fischer, and others, as well as the specimens here presented, give strong evidence that in the first stage all diverticula are of the true type, and that only subsequent pressure destroys the muscular coats, showing that the muscular coats previously exhibited a weakened condition. The conditions found in the infant colons above referred to is very significant in this connection.

The pathology of intestinal diverticulum needs to be considered under two distinct conditions: its pathology when uncomplicated by secondary changes, and the pathology when such changes have intervened. A detailed study of this has been made by us on the material at our disposal, and is reported in full. Emphasis will be laid at this time only on those points which are of clinical significance.

It must be borne in mind that the diverticulum itself is absolutely a harmless condition as far as the health of the individual is concerned. Of the specimens reported in this paper, eighteen in number, four were the cause of symptoms during life. In each one of these the symptoms were due, not to the actual diverticulum, but to the secondary changes occurring from it. Telling names eleven possible conditions which may give rise to symptoms, and illustrates each one of them by one or more of the cases which he summarizes. Some of these are so nearly related, the one to the other, that they may be considered modifications of the same process, and their separation seems to confuse rather than to simplify. A practical working classification of the secondary changes which give rise to symptoms is one which is in every way comparable to those occurring in the case of the appendix.

1. There may arise an acute inflammation of the diverticulum without perforation, which results in a peritonitis or a cellulitis around it. Loomis¹⁸ reports one case in which general peritonitis so resulted. The formation of adhesions to neighboring parts may cause an obstruction, more or less acute, either at the site of the diverticulum or in a loop of gut adjacent to it.

2. The inflammatory process may cause destruction of the coats of the diverticulum when a perforation results, leading either to a

¹⁷ Virchow's Arch. f. path. Anat., 1894, cxxxviii, 347.

¹⁸ New York Medical Record, 1870, iv, 497.

localized abscess, a general peritonitis, a general blood infection, or all three. The perforation may communicate with other hollow viscera, notably the bladder. Telling cites a case showing submucous perforations, so that fistulous tracts formed within the intestinal wall.

3. The diverticula may become the seat of a mild, subacute, or chronic inflammation, which does not produce marked changes. This condition is subject to temporary exacerbations and remissions. (Giffin,¹⁹ Mayo.)

4. A chronic inflammation may occur in the diverticulum which leads to thickening of the walls of the diverticulum itself, and from the irritating effect of the toxins in the lymphatics and venules, the process spreads to the surrounding tissues, resulting in thickening of the whole intestinal wall and of its mesentery. When multiple diverticula are present, a long piece of the gut may be involved. Here, again, adhesions may lead to intestinal obstruction, or this obstruction may result from narrowing of the lumen. Here, also, a chronic perforation may take place.

5. Carcinoma may develop on the diverticulum. (Hochenegg,²⁰ Wilson and Giffin.²¹)

Comparing these changes with those of the diseased appendix, we find them exactly analogous: that is, acute inflammation without perforation; acute inflammation with perforation; subacute and chronic inflammation without marked thickening; chronic inflammation with marked thickening; and carcinomatous development. The question naturally arises as to what is the cause of these changes. In the majority of cases they are probably due to the irritation caused by the fecal concretions in the intestines. For this reason the secondary changes are almost invariably found in the large intestinal diverticulum, where the solid feces become impacted in its lumen.

Gordinier and Sampson²² report one case of inflammatory changes in a mesenteric cyst of the small intestine, with the presence of many diverticula in the adjoining intestine. But they fail to give microscopic evidence that the cyst was actually developed from a diverticulum.

The analogy between the causative factor in diverticulitis and appendicitis is again close, namely, irritation from fecal concretion. On the other hand, owing to the motility of the appendix on its mesenteric axis, it is liable to serious damage from circulatory disturbance which is not present in the case of the diverticulum. Consequently, acute gangrenous appendicitis is common, but acute gangrene of a diverticulum as a whole probably never occurs. Another distinguishing difference is, that inflammatory changes in

¹⁹ AMER. JOUR. MED. SCI., 1909, cxxxviii, 661.

²⁰ Verhandl. d. deutsch. Gesellsch. f. Chir., 1902, 402.

²¹ Trans. Amer. Surg. Assoc., 1907, xxv, 237.

²² Jour. Amer. Med. Assoc., 1906, i, 1585.

the appendix usually involve the mucous membrane to a marked degree, while the mucous membrane lining the diverticulum often escapes until actual perforation is imminent. Wilson discusses this, and would restrict the term "diverticulitis" to those cases in which the mucosa is primarily involved, and use the term "peridiverticulitis" for those cases in which the outer coats of the bowel and surrounding structures are inflamed. The former causes no material reduction of the lumen of the bowel, but tends to perforation into the peritoneal cavity. The latter produces a marked narrowing of the lumen, but owing to the marked reparative process, does not so readily lead to perforation. This distinction of terms seems to us rather superfluous, because the subserosa is quite as much a part of the diverticulum as is the mucosa. Moreover, in many of the cases in which perforation has been reported clinically a condition of "peridiverticulitis" did exist. It is also important to note that the inflammatory changes in diverticula are most marked in the connective tissue coats of its wall, the submucosa and the subserosa.

For this reason it is probable that the acute perforations result in chronically inflamed diverticula, and that the acute inflammations themselves are usually superadded upon a chronic inflammation. The tendency of a perforation of the diverticulum to communicate with the bladder is worthy of emphasis. Formerly, these communications between the sigmoid and the bladder were attributed mostly to cancer, but Harrison Cripps²³ collected sixty-five cases of vesicocolic fistula, in forty-five of which an inflammatory process was shown to be the underlying cause, as against nine in which cancer was so related.

The clinical manifestations of these conditions are readily understood by a direct application of these pathological changes.

It must again be emphasized that the diverticulum itself, that is, a pouch of the intestinal wall, is not capable of giving symptoms. It is only when added to this, there exist some of the secondary changes above described that the symptoms arise. Autopsy records show the frequent presence of diverticula which, even when packed full of feces during life, have given no hint of their presence (Fig. 5). Moreover, a very considerable degree of inflammation in the diverticulum, and in the immediate vicinity, may be present without giving symptoms. This is well illustrated in one of the clinical cases in this series in which a chronic perforation took place with no accompanying signs until the moment of perforation.

On the other hand, there may be evidences of the secondary changes present during the chronic stage. These are: disturbance of the action of the bowels, usually constipation, and possibly a dull aching pain.

These cases may recover spontaneously, according to Mayo,²⁴ and

²³ *Disser.*, London, 1888.

²⁴ *Surg. Gyn. Obstet.*, 1907, v, 8.

he reports a case in which recurrent symptoms had been present over a period of years. Here, again, we see an analogy to appendicitis.

There are no symptoms referable to the varying inflammatory conditions that are in any way pathognomonic. The same clinical picture is seen when similar pathological processes are present from other causes. For this reason, rarely, if ever, has a positive pre-operative diagnosis been made, and an error is not infrequent, even on opening the abdomen. However, certain symptoms are significant, and with our increasing knowledge, errors both before and during operation will become more infrequent.

The predilection of the descending colon and sigmoid to be the seat of serious changes in diverticula, leads at once to a tentative diagnosis of this condition when evidence of acute or chronic inflammation exists in the left lower quadrant of the abdomen. (One

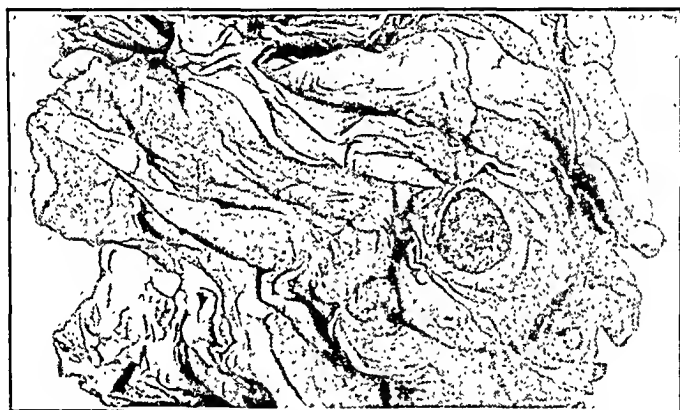


FIG. 5.—Diverticula of the colon. The diverticulum is stuffed with feces. (Case XI.)

of our clinical cases, however, was in the ascending colon.) This, occurring in persons in the middle decades of life, is sufficient to suggest a diverticulum as the starting point of the trouble, but it must be emphasized that an increasing number of cases showing inflammatory symptoms are being found in young persons. The symptoms may be those of a local abscess, a more or less general peritonitis, or a partial or complete intestinal obstruction. They may be acute, subacute, or chronic. Owing to the absence of ulcerative changes in the mucous membrane, diarrhoea and blood in the stools are the exception, though the latter existed in the case of Moschcovitz, the specimen from which is included in this series. The usual absence of these symptoms helps to differentiate the condition from tuberculous inflammations, and, to a certain extent, from syphilitic inflammation and carcinoma.

In those cases in which the inflammatory exudate is extensive,

leading, as it may, to a palpable tumor, there are no clinical manifestations which differ from a similar condition due to other causes. The absence of other evidence of tuberculosis or syphilis, and the absence of blood in the stools, all point to the presence of diverticular trouble, but a positive diagnosis cannot be made. The greatest difficulty exists under some circumstances in excluding carcinoma of the sigmoid. The resemblance to this neoplasm is so close that many surgeons have been in error after opening the abdomen, the thickened indurated section of the gut being in every way the same in both processes, and primary resection has been done because of the mistaken diagnosis. Telling, in his pathological classification, gives as one type those mimicking carcinoma, and adds that he believes that many an inflammatory lesion would be found to be present in jars on museum shelves labelled "carcinoma," if their contents were carefully examined.

Moynihah²⁵ reports five cases in which a resection was done in the erroneous belief that cancer was present. In two of these the lesion was positively demonstrated to be due to diverticular inflammation. In a sixth case the indurated colon and sigmoid were believed to be the result of cancer, and the case was considered inoperable. The subsequent recovery proved the error of this diagnosis, and the case probably should be included as diverticulum disease. An enterovesical fistula, with gas or fecal matter passing out with the urine, points to a diverticulum rather than to cancer. Thus we see that, clinically, we recognize a classification which conforms in every particular with that adopted for the secondary pathological changes.

Beer, Telling, Eisendrath,²⁶ and others have formulated tables of such classification, which possess merit. However, an understanding of the possible anatomical lesions serves every purpose, and since all these lesions have now been reported clinically, a table of clinical possibilities is nothing more than a repetition.

The treatment for the secondary changes growing out of the presence of diverticula, except the milder grades of chronic inflammation, is purely operative. A laparotomy must be performed, and the actual condition met with must be treated on the general principles of intestinal surgery. In the case of a perforation, it may be dealt with by simple excision of the necrosed area, and suture, or a section of gut may be excised and an anastomosis done. The latter is only needed when the perforation is large, and the adjacent gut wall is so thickened that a proper closure cannot be effected.

A second indication for excision of the gut is the narrowing of the lumen by inflammatory thickening to a point which threatens its patency. But in this connection it must be remembered that much of the inflammatory exudate may be absorbed when the exciting cause, namely, the inflamed diverticulum itself, is removed. On

²⁵ Brit. Med. Jour., 1907, ii, 1381.

²⁶ Arch. of Diag., 1909, ii, 368.

the other hand, we must bear in mind the possibility of more than one diverticulum being present, so that a proper attention to the perforation, or the most apparent pouch, may not remove the causes exciting inflammation. Again, the possibility of the development of cancer as a subsequent change must be given its full weight in deciding against intestinal resection.

The surgical management of the local abscess, the general peritonitis, the adhesive ileus, or the fistulous opening into the bladder is exactly similar to these conditions from other causes and needs no amplification here.

The following clinical cases and postmortem specimens illustrate many of the facts included in the foregoing *resume*. The clinical cases have all been presented before the New York Surgical Society during the session of 1909-1910. So far as we know, none of the other cases have been previously reported.

CASE I (Hartwell, Presbyterian Hospital).—O. G., male, aged forty-two years, mechanic; was admitted to the Presbyterian Hospital, in the service of Dr. Eliot, to whom I am indebted for the privilege of reporting the case, on April 21, 1909, suffering from an acute abdominal lesion. The family and past history were negative. Two days before admission he developed the typical symptoms of an acute intestinal obstruction, and these had increased continuously until admission. For three or four days prior to the acute symptoms he had noticed that his bowels were constipated—an entirely unusual thing.

Physical examination on admission showed the abdomen uniformly distended and tympanitic. About one inch inside the anterior spine of the ileum, and above it, was felt an elongated mass along the course of the sigmoid, the size of an apple. This mass was tender. Careful questioning failed to get any evidence that the patient had ever been conscious of any abdominal lesion prior to the onset of the acute symptoms. With these, however, the pain was most severe at first at the site of the tumor.

Under gas-and-ether anesthesia a laparotomy was immediately done, the peritoneum being opened over the mass. A walled-off abscess was found lying outside the sigmoid, just above the pelvic brim, which communicated with the lumen of the bowel through a gangrenous looking perforation. For a distance of about two inches the entire bowel wall was markedly thickened, as was the mesentery connected with it. There were two adhesion bands kinking and pressing on the gut in such a way as to cause the obstruction, but it was noted that the colon, as far as could be seen above this point, was not unduly distended. No diagnosis was made as to the pathology of the lesion. Cancer and tuberculosis were thought of as the most probable, though diverticulitis also was mentioned. A primary resection of the diseased portion was done, with an end-to-end suture anastomosis. The abdominal wound was sutured with drainage.

The post-operative course was unsatisfactory, and the symptoms of obstruction increased rather than lessened. After twenty-four hours, therefore, the wound was opened, and as the anastomosis did not look entirely satisfactory, though the lumen was patent, the stitches were removed and a Murphy button inserted. The patient recovered after a rather tedious convalescence, and has remained well up to present time.

The specimen removed consists of a piece of sigmoid 7 cm. long. (Fig. 6). The peritoneal fat and appendices epiploicæ are abundant. On the external aspect of the section is an indurated mass, irregularly



FIG. 6.—Part of the sigmoid. On the right is an indurated mass of inflammatory tissue, laid open along the tract of the perforating diverticulum. (Case I.)

globular, measuring 4 to 6 cm. in diameter. This mass lies within the gut wall and is covered externally with peritoneum and intestinal fat. Through this mass passes a perforation into the intestinal lumen, admitting a surgical probe. The surface of this sinus is ragged and ulcerated. The perforation passes through the posterior part of the mass, and a transverse section through the mass shows the mucous membrane pouching out along the line of the perforation, demonstrating the presence of a diverticulum at this point. There are four other diverticula present, having an average depth of $\frac{1}{2}$ cm.; two of those lying adjacent to the one that has perforated

show a lesser amount of induration in their walls. Microscopically,²⁷ a section taken through the tract of the perforation shows extensive necrosis and acute inflammatory changes involving all the coats of the gut (Fig. 7). At one place the mucosa dips down as if to form a diverticulum, but becomes almost at once unrecognizable in a mass of necrotic tissue. This necrosis involves the muscularis, which is considerably thinned out at this point, as well as the subperitoneal fat tissue. The parts surrounding the necrosis are densely

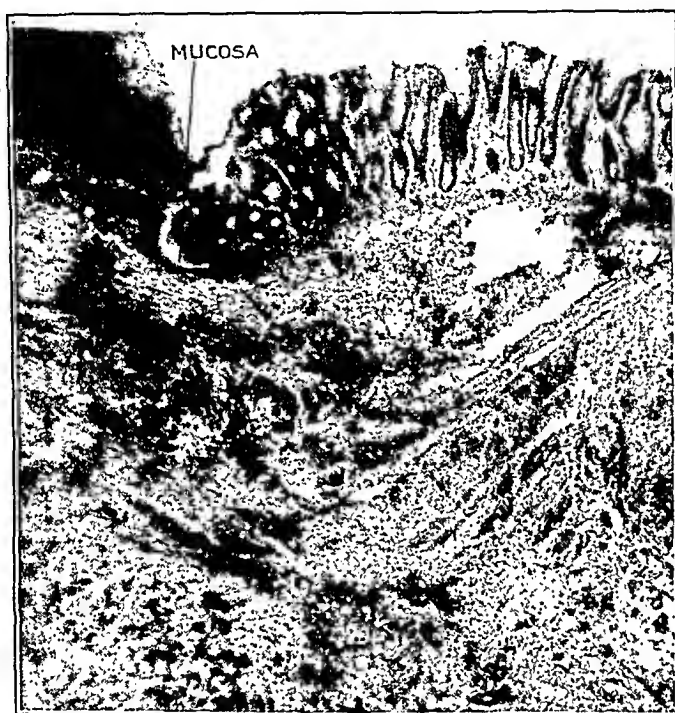


FIG. 7.—Microscopic section through a perforating sinus. The section shows the mucosa abruptly terminating in a mass of necrotic tissue. The wall of the gut is thickened and infiltrated with leukocytes. (Case I.)

infiltrated with polymorphonuclear leukocytes and lymphoid cells. Sections through two of the adjacent diverticula shows both of them to be true diverticula, being surrounded by normal muscularis of the usual thickness. The subserosa contains many lymphoid cells, with a few polynuclear leukocytes. Both of these diverticula are more or less cylindrical in shape, maintaining about the same diameter throughout their entire length. The deeper one measures 1.2 cm. in length; the other, 0.7 cm.

²⁷ In the microscopic study of the diverticula, the following technique was used: The sections were cut either longitudinally—that is, parallel to the long axis of the intestine—or transverse to this axis, or both. All sections thus include normal intestine adjacent to the diverticulum and the structures occurring in the neck and fundus of the sac. The sections were stained with hematoxylin and eosin. In addition, duplicates of each section were stained by the Van Gieson method. In every instance, small diverticula, never over 1.5 cm. in diameter, have been used for the microscopical sections.

CASE II (Hartwell).—Male, aged twenty-three years. Admitted to the Presbyterian Hospital August 9, 1909, giving a complicated clinical picture, which is reported in full elsewhere.²⁸ He presented at operation the following condition: The abdomen contained a small amount of fluid, of characteristic serous exudate. The large intestine, from the splenic flexure to the rectum proper, was found to be the seat of a marked uniform thickening, involving its whole circumference. This wall was estimated to be about $\frac{3}{8}$ inch in thickness, so that the intestinal tube was rigid and hard, but its lumen was not appreciably narrowed. At the splenic flexure the lesion had, to a certain extent, kinked the bowel, causing a moderate degree of obstruction. The mesentery of the descending colon was thickened quite as much as the bowel itself. The spleen was soft and somewhat enlarged. No other lesions were found in the peritoneal cavity, a thorough examination being made to find tuberculosis, but without avail. The adhesions which were causing the obstruction were loosened, and the whole length of the descending colon was examined for the purpose of finding a perforation or any other cause for the condition at hand. The process gave all the appearances of a simple inflammatory thickening, involving the bowel and its mesentery. It was impossible to eradicate the disease, consequently the abdomen was closed with drainage. A pathological report on the peritoneal fluid showed it to be sterile.

A microscopical examination of a small piece of the tissue removed from the surface of the bowel showed it to be fat, infiltrated with small round cells, and extravasated blood. There was an increase of fibrous tissue and the walls of the bloodvessels were thickened, and the lumen contracted. There was no especial perivascular change, and no evidence of either syphilis or tuberculosis could be found. The diagnosis made by the pathologist was chronic fibrous peritonitis.

The postoperative history was uneventful. There was but little drainage from the wound, and it healed kindly. Since his discharge from the hospital, on September 10, the patient has been attending to his work, and is in very excellent general health. There is still present a mass in the left lower abdomen, which is not materially changed since the operation, but it gives rise to no symptoms whatever. All the evidence at our disposal points to the condition of the colon as being one of a simple inflammatory process involving the coats outside of the mucous membrane. Tuberculosis and syphilis both involve the mucous membrane, and give symptoms of this involvement. Cancer must be ruled out by the extent of the disease, and the subsequent good health of the patient. On the other hand, such inflammatory thickening arises from diverticulitis, as has been amply demonstrated, both by previous writers and by the specimens

²⁸ Proc. New York Surgical Society, *Annals of Surgery*, April, 1910.

here presented, and we therefore think that it is proper to include the case as one of probable multiple diverticulitis. In this connection Telling states that he has found the thickening to be more marked in those diverticula with small openings, and narrow channels. Such diverticula cannot be demonstrated from the external surface of the thickened bowel.

Case I showed the same condition in a local area, but here a perforation was also present. These are the cases that give the mimicry of cancer.

CASE III (Hartwell).—A. G., female, aged forty-three years. Admitted to the Presbyterian Hospital, August 30, 1909. For ten years she had suffered from recurring attacks of abdominal pain, coming on at night and being relieved by vomiting. The pain was general, but was most severe in the epigastrium. Two years prior to admission into the hospital the pain began to localize itself in the right lower quadrant of the abdomen. With the attacks there was fever. They recurred every three or four months, and lasted about one week. She habitually suffered from constipation. There was never any knowledge of blood in the stools. The physical examination showed no abnormalities except some evidence of a chronic pelvic peritonitis, and a mass in the right lower quadrant of the abdomen. This was about the size of a billiard ball, of stony hardness, and fairly smooth surface. It was tender to pressure. It occupied the middle outer part of the quadrant, and was firmly adherent to the posterior abdominal parietes.

Operation was performed on September 12. On opening the peritoneum the mass was found to lie just outside the cecum, and to consist of the appendix, the cecal wall, and adventitious tissue. The appendix was much thickened, but not acutely inflamed. It lay with the tip pointing upward, outside of the cecum, buried in hard tissue. On dissecting it free, the tip was found to be closely adherent to the colon, just anterior to the outer mesenteric leaf, where it closed a necrotic opening 0.5 cm. in diameter in the much thickened and hard wall of the colon. This opening admitted a probe into the lumen of the bowel. The appendix was removed. The tissue for some distance around the sinus was cut away in two pieces, and the opening thus made closed with three layers of sutures. The lumen of the colon and cecum contained old, partially digested blood clots, the origin of which could not be determined.

The post-operative course was uneventful, and the patient remains well at the present time.

The specimen consists of: (1) Two pieces of intestinal wall (cecum), both of which show considerable thickening. In one of the pieces there is a small sacculle, 8 mm. in diameter and 9 mm. in depth, lined with mucous membrane, which appears to have pushed through the muscularis. (2) An appendix, 4 cm. in length; serosa of distal portion covered with fibrin; no perforation; mucosa smooth. Micro-

scopically: (1) Sections taken through the diverticulum show a small sac lined with intestinal mucosa, which is thrown up into small folds. At one point the mucosa is necrotic. The lumen of the sac contains pus. The wall of the sac is composed of fibrous tissue, apparently thickened serosa, infiltrated with polymorphonuclear leukocytes and lymphoid cells, but free from necrosis. No muscular tissue remains in the wall. Its blunt point of termination on either side of the sac is sharply defined (Fig. 8). The terminal muscle fibers show signs of atrophy and are being replaced by fibrous tissue. (2) Sections through the cecum adjacent to the diverticulum show considerable thickening of the muscularis and serosa, and a universal infiltration by polymorphonuclear leukocytes, lymphoid and plasma cells in all the coats. There is a formation of fresh granulation

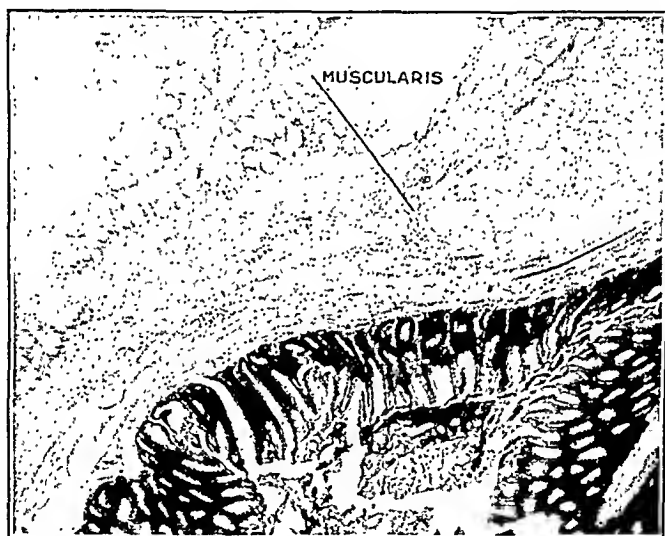


FIG. 8.—Microscopic section through a diverticulum. (Only half of the diverticulum is shown.) The muscularis ends abruptly at the neck of the sac. The wall of sac is composed of mucosa and serosa. The latter is infiltrated with leukocytes. (Case III.)

tissue on the serosa. (3) Appendix. The mucosa is intact. The muscularis and serosa contain a moderate number of lymphoid cells. The serosa is thickened. Our interpretation of this case is that the cecum contained a number of diverticula. One of these had perforated and sloughed away. A second one, acutely inflamed, is the one from which the above described section was taken.

CASE IV (Moschcowitz).—Female, aged thirty-seven years. This patient had suffered from a number of conditions requiring surgical attention in earlier life. Among these was an acute appendicitis, for which she was operated on in 1904, and gastric ulcer, which was cured without operation. In 1905 she first began to suffer from intestinal trouble, which manifested itself by diarrhea, tenesmus, and blood in the stools. Examination then showed a tender sausage-

shaped mass in the left iliac fossa. In June, 1906, she was operated on, and a condition of retraction and contraction of the mesosigmoid, with many scar-like adhesions taking their origin from multiple diverticula of the sigmoid, was found. Separation of the adhesions, and straightening out of the intestinal coils gave relief for about two years, when the symptoms recurred. In March, 1909, a resection of the diseased portion of the sigmoid was done, and this has resulted in a complete cure up to the present time. The specimen consists of a section of the sigmoid, 12 cm. in length, hardened in formalin. After opening along the anterior border, inspection from the inside shows fourteen diverticula. These are all small, having a communication with the intestine, 0.5 cm. in diameter, and a depth of 0.5 cm. None showed marked evidence of inflammation. In the hardened specimen there is no evidence of their presence on the peritoneal surface of the gut. The whole intestinal wall, however, seems somewhat thickened. Microscopically, a longitudinal section through one of the diverticula shows the following: The mucosa lining the sacculi is normal. The submucosa shows no changes. The circular coat of the muscularis is very much thinned over the fundus of the sac. The longitudinal layer maintains its normal thickness. The submucosa contains considerable fat tissue. In the region of the diverticulum it is infiltrated with a moderate number of polymorphonuclear leukocytes and lymphoid cells. The serosa is thickened. The intestine adjacent to the diverticulum is normal.

CASE V.—The patient from whom this specimen was obtained was a male, aged forty-eight years. He died in the Bellevue Hospital from general metastases, following an epithelioma of the oesophagus. Nothing in the history gave any indication of a lesion existing in the sigmoid. There was no evidence of any cardiac trouble nor any condition leading to portal congestion.

The specimen consists of the lower end of the sigmoid, measuring 12 cm. in length, and containing six diverticula, all of which have a long, narrow neck, barely admitting a small probe, through which they connect with the lumen of the intestine. The diverticula are spherical in shape, and measure about 0.5 cm. in diameter. They are filled with semisolid feces. This feces, owing to the narrowness of the outlet, are practically prevented from reëtrance into the lumen of the bowel. The position of the diverticula is on either side, between the anterior and lateral teniæ. In some cases the diverticulum is in close relation to an appendix epiploica. In others, no such relation can be demonstrated. The thickness of the intestinal wall is distinctly greater in that portion where the diverticula are present than in that portion where they do not exist.

Microscopically, sections taken transversely through two different diverticula present the same picture. The mucosa is thick at the neck, but becomes thinned out in the fundus. The muscularis of the adjacent gut is hypertrophied, but only a small part of the longi-

tudinal layer passes about the diverticula, forming a thin strip of atrophied muscle between the mucosa and serosa. By the use of Van Gieson's stain, considerable fibrous tissue is found between the muscle fibrillæ about the diverticulum. The subserosa contains several fairly large bloodvessels, both arteries and veins, and a considerable quantity of adipose tissue. The serosa appears normal. There is no sign of acute or chronic inflammation in any part of the sacculæ.

CASE VI.—The specimen was removed from a male, aged seventy-five years, who died in the Presbyterian Hospital following a resection of the small intestine for gangrene in a strangulated hernia. The autopsy showed a general arterial sclerosis and a chronic endocarditis, but there was no evidence of congestion in the abdominal viscera. The specimen consists of a small section of the transverse colon, which presents one diverticulum. This arises from a plane midway between the anterior and one of the lateral tenia. It is exactly globular in shape, and measures 1 cm. in diameter. It communicates with the lumen of the gut by a circular opening, also 1 cm. in diameter. The sac of the diverticulum contains an elliptical enterolith about 0.5 cm. in its long axis and 0.25 cm. in its short axis. This, therefore, lies loose, and is not impacted. The walls of the diverticulum are distinctly thinner than the wall of the gut around it. This specimen was preserved intact, so that no microscopic sections were taken.

CASE VII.—The specimen was obtained from a boy, aged six years, who died in coma in the Presbyterian Hospital from an acute infectious condition of only twenty-two hours' duration. The only abnormalities found at autopsy by the coroner were those described below, under the specimen, and a condition of ulceration in other parts of the colon and lower ileum.

The specimen consists of a piece of colon showing three haustra. Each of these is more sacculated than normal. The specimen is opened along the mesenteric line. In one of the haustra the walls are distinctly thinner than in the others, and here exist two diverticular pouches, one on either side of the anterior tenia (Fig. 3). They are exactly similar, being globular in shape, and measuring about 2 cm. in diameter. Their communication with the lumen of the gut is by a circular opening of the same diameter. The condition, therefore, is more a giving way of the whole wall of the gut in an intermuscular portion than the presence of actual diverticula. The thickness of the wall in this weakened haustra is much less than in those adjoining it.

Microscopically, a section through the diverticulum, taken longitudinally, shows a small sacculæ lined with flattened mucosa, but completely surrounded by a muscularis, which consists of both the circular and longitudinal layers. Both layers are considerably thinner here than in the adjacent intestine, but in all other respects

they appear normal. The serosa and subserosa are normal. The intestine adjacent to the diverticulum is normal.

CASE VIII.—This specimen was obtained from a female, aged ten years, who died in the Presbyterian Hospital from a septic meningitis following otitis media. There was nothing in the history pointing to any intestinal trouble. At the autopsy nothing was found indicating any interference with the venous circulation of the abdominal viscera.

The specimen consists of a small piece of the sigmoid, which has been opened along the mesenteric line. There is one diverticulum present. Its communication with the intestine is oval, measuring 1 cm. in length and 0.5 cm. in width, the longer diameter being transverse to the axis of the gut. The pouch is about 0.5 cm. deep, and is of the same diameter as the opening into the intestine. There is no appreciable difference in the thickness of the wall of the diverticulum and that of the intestine about it. The position of the diverticulum is midway between one of the lateral tenia and the mesenteric line.

No relation to an appendix epiploica can be made out.

Microscopically, transverse sections through the diverticulum show the following changes: The mucosa lining the saccule is flattened. The submucosa is normal. The muscularis becomes rapidly thinner as it passes on to the diverticulum, but does not disappear entirely (Fig. 4). Over the fundus it has been largely replaced by fibrous tissue, and it is only in sections stained by Van Gieson's method that the atrophied muscular fibers, chiefly of the longitudinal coat, can be recognized. The serosa and subserosa are normal. There are no large vessels in the wall of the sac. The intestine adjacent to the sac is normal.

CASE IX.—This specimen was obtained at the autopsy in a female, aged sixty-five years, who died in the Presbyterian Hospital from chronic obstructive jaundice due to calculus, gangrene of the gall-bladder, and septic cholangitis. The heart was dilated, but there was no evidence of any disturbance of the circulation in the intestinal veins.

The specimen consists of a piece of the descending colon and sigmoid, measuring 60 cm. in length. In its lower half are counted fourteen diverticula, many of which are filled with fecal concretions. The average diameter of the opening into a diverticulum is 0.5 cm. The average length is 1 cm., and the fundus of the sac is usually about twice the diameter of the neck. Each diverticulum has its os lying in a plane midway between a lateral tenia and the mesenteric line, and the sac extends outward into an appendix epiploica. There is no gross evidence of any inflammatory thickening about the diverticula or in the intestinal wall adjacent to them. On the contrary, in those diverticula which are distended with feces, the fundus of the sac seems distinctly thinner than the rest of the gut wall.

Microscopically, transverse and longitudinal sections through the diverticula show no inflammatory changes. The mucosa is slightly flattened. The circular layer of muscularis becomes greatly thinned at the neck of the diverticulum, and soon disappears. A slender band of longitudinal fibers, containing considerable fibrous tissue, completely encircles the sac. The transverse section shows a large artery and vein in the subserosa of the fundus. The serosa is normal.

CASE X.—This specimen was obtained at the autopsy of a male, aged fifty-six years, who died in the Bellevue Hospital of acute lobar pneumonia. The clinical history gave no evidence of any intestinal lesion. Neither the clinical history nor the autopsy gave evidence that any chronic disturbance in the intestinal venous circulation had been present.

The specimen consists of a portion of the ileum. At one point opposite the mesenteric attachment there is a Meckel's diverticulum, measuring 9 cm. in length and 3 cm. in diameter throughout its length. On this diverticulum are distinctly seen four secondary diverticula, each about 1 cm. in diameter and 0.5 cm. in depth. There is a slight constriction near the middle of the large diverticulum, corresponding to the line of the obliterated vessel coming from the mesenteric border. On opening the intestine this pouch communicates with the lumen of the gut by a circular opening 2 cm. in diameter. The secondary diverticula can be seen opening into the large pouch.

CASE XI.—A male, aged sixty-six years, died in the Bellevue Hospital from general arterial sclerosis and cardiovascular disease. General anasarca was present and there was very severe congestion of all the abdominal viscera.

The specimen consists of the cecum and a portion of colon measuring 12 cm. in length. Five diverticula are present, varying from 0.25 cm. to 2 cm. in diameter. The larger ones are filled with hard, fecal masses (Fig. 5). The communication with the lumen of the gut is always smaller than the pouch of the diverticulum, but there is no neck. The expanded pouch around the mouth of the sac is thinned, and the wall of the pouch itself is distinctly thinner than the surrounding intestinal wall. The diverticula lie in planes between the mesenteric line and the lateral tenia on either side. One diverticulum is in the cecal pouch itself, and on the external surface lies 2 cm. external to the origin of the appendix vermiformis.

Microscopically, a section taken transversely through one of the diverticula shows the following: The sac is connected with the lumen of the intestine by a very small opening. The mucosa is reflected over the margin of this opening and lines the entire sac. The portion in the sac, however, is thinner than that lining the adjacent gut and is covered with a layer of structureless material. The submucosa is normal. The circular layer of the muscularis

surrounds the sac, but shows a marked thinning, and more or less replacement with fibrous tissue. The longitudinal fibers are not found in the wall of the sac. A large artery and vein lie in the subserosa of the fundus of the sac. The serosa and subserosa are normal. The intestine adjacent to the diverticulum is normal.

CASE XII.—The specimen was obtained from a male patient, aged sixty-eight years, who died in the Presbyterian Hospital from carcinoma of the prostate, bladder, and liver, the primary lesion being in the liver. There was no evidence at autopsy of any interference with the circulation in the intestinal veins.

The specimen consists of the whole large intestine. In the cecum there are three diverticula measuring 3 to 9 mm. in diameter. Surrounding them is a distinct area of inflammation. The transverse colon and sigmoid show an increasing number of diverticula, all small in size. The diverticula are distributed irregularly and show no definite relation to the mesentery or tenia. These diverticula vary in diameter from a few mm. to 1 cm. The entrance to the diverticulum is always much smaller than the lumen of the pouch itself. The wall of the descending colon and the sigmoid is much thickened by tissue in the middle layers of the wall. At one point this thickening is extreme, the wall measuring nearly 2 cm. in thickness. In this situation the diverticula are very numerous, being closely packed together. Microscopically, a section taken transversely through two adjacent diverticula in the sigmoid shows the following changes: The mucosa in both sacs is intact but infiltrated with a large number of small, round cells of the lymphoid type. The submucosa shows a similar infiltration. Over the fundus of one sacculus the submucosa is necrotic and contains several large vacuoles which suggest that the tissue has contained gas. As there are no polynuclear leukocytes about this area, it is probable that the change is a postmortem one. The circular layer of muscularis has undergone considerable hypertrophy, a change which can be observed not only in the wall of the intestine between the diverticula, but in the lateral walls of the diverticula themselves. Over the fundi, however, the muscularis becomes thin. The longitudinal layer of the muscularis is not made out. At many points the muscularis of the sac wall is densely infiltrated with lymphoid cells. Large vessels occur in the subserosa of both sacculi. The subserosa contains a good deal of adipose tissue and many lymphoid cells. The serosa is normal. Another section taken through one of the diverticula in the ascending colon shows no inflammatory changes, and no hypertrophy of the muscularis. A thin strip of the circular layer of muscularis surrounds the sacculus.

CASE XIII.—The specimen (Museum specimen, Bellevue Hospital) consists of a portion of small intestine, 30 cm. in length. Seven small oval diverticula, varying in size from 0.5 to 1.5 cm. in diameter, occur along the mesenteric border between the folds of the mesentery,

but bulging more on one side than on the other. In each case a vein may be seen travelling from the convex border of the intestine in the subserosa, and passing directly over the diverticulum to reach the mesentery. This vein is always present only on the side toward which the diverticulum bulges. The leaves of the mesentery can be stripped off the diverticula.

On opening the gut, the communication between its lumen and the diverticulum is seen in each case to be smaller than the diameter of the diverticulum itself. Three additional openings are found communicating with diverticula too small to be identified from the external surface. The opening into the diverticulum is situated, in most cases, on one side of the mesenteric line. A few seem to correspond exactly to its line of attachment. The same relation of the diverticulum to the vein is manifest, and it is the course of this vein toward the mesentery that determines the direction of the growth of the diverticulum.

Microscopically, sections have been taken transversely through the gut at the site of one of the small diverticula. The mucosa and submucosa are everywhere normal. The muscularis extends down for some distance over the sacculi, but is absent over the fundus. The longitudinal layer extends further down than the circular. It becomes gradually thinner and finally disappears. The serosa and subserosa are not thickened. There are no large vessels in the wall of the sacculi. The intestine adjacent to the diverticulum is normal.

CASE XIV.—The specimen (museum specimen, Bellevue Hospital) consists of a piece of small intestine 40 cm. in length, showing thirteen diverticula, varying in diameter from 0.25 cm. to 6 cm.; eleven of these are crowded together into a piece of intestine only 22 cm. long, so that there is practically no part of the mesenteric border free from a diverticulum. The same relationship between the diverticula and the mesentery and veins is present as described in Case XIII. The walls of the larger diverticula are somewhat thicker than those of the smaller ones. There is no communication between the individual diverticula even where they are close together.

Microscopically, a section taken longitudinally through the gut displays a portion of diverticulum of rather large size. The mucosa is flattened. The submucosa is normal. The two coats of the muscularis extend down over the sacculi, but become much thinner at the neck. The circular layer becomes rapidly thinner and soon entirely disappears. The longitudinal layer appears to continue as a thin strip clear around the sac. The serosa and subserosa are normal.

CASE XV.—The specimen (museum specimen, Bellevue Medical College) consists of several small pieces of colon showing diverticula packed rather closely together and varying in size from 1 cm. to 3 cm. in diameter (Fig. 9). They show the same general characteristics as the other specimens, but owing to the way in which the specimen has been mounted, the relation of the diverticula to the mesentery and vessels cannot be determined.

Microscopically, sections taken transversely through a small diverticulum show considerable postmortem change, but the different coats can still be made out. The mucosa and submucosa are normal. The muscularis, both the circular and longitudinal, extends up for some distance on either side of the neck, but becomes progressively thinner and soon disappears. Occasional bundles of the longitudinal fibers occur over the fundus. The serosa and subserosa are normal. No large vessels are found in the subserosa.

CASE XVI.—The specimen (museum specimen, Presbyterian Hospital) consists of the duodenum, which shows the presence of eight small diverticula, the largest measuring 1.5 cm. in diameter, all of which occur in close relation to the mesenteric attachment. All but one are situated in the portion of duodenum distal to the papilla of Vater. The general appearance and gross structure is the same as that described for those in other parts of the small intestine.

Microscopically, the diverticula were studied in transverse and longitudinal sections. The walls of the saccules are composed of normal mucosa and considerably thickened serosa. Both the transverse and longitudinal portions of the muscularis come to a rather abrupt ending at either side of the neck of the sac. There is a large artery in the subserosa of one of the saccules. The intestine adjacent to the diverticula shows no change.

CASE XVII.—The specimen (museum specimen, Bellevue Medical College) consists of a section of colon 10 cm. in length. On the two lateral aspects of the intestine are closely crowded together fusiform diverticula, from 1 cm. to 1.5 cm. in length and 0.75 in diameter (Fig. 4). The bases of the diverticula lie in two lines directly posterior to either lateral tenia. There is a distinct



FIG. 9.—Diverticula of the colon, showing the openings of the diverticula into the gut. (Case XV.)

interval of normal intestinal wall lying between the mesenteric attachment and the diverticula on either side.

On opening the intestine, each diverticulum is seen to communicate with the lumen by an opening somewhat smaller than the diverticulum itself. This inequality, however, is not nearly so marked as in some of the other specimens. In two instances, two diverticula communicate with the intestine by a common opening, the septum which originally separated them having in part disappeared. In each of these cases the two individual diverticula lie in an oblique, nearly transverse plane.

Microscopically, transverse and longitudinal sections through the diverticula present similar pictures. At one point the wall of the gut is greatly thinned out, and takes the form of a small saccule.



FIG. 10.—Microscopic section through a diverticulum. The muscularis terminates suddenly at the neck of the sac. The mucosa and serosa are greatly thinned. (Case XVII.)

The muscularis terminates suddenly on either side of the diverticulum, so that the wall of that structure is composed only of mucosa and serosa (Fig. 10). The former is very thin, and atrophic looking, the crypts having largely disappeared. The serosa is also quite thin. The intestine adjacent to the diverticula exhibits no changes. In neither the transverse nor the longitudinal sections can any large vessels be found.

CASE XVIII.—The specimen (museum specimen, Presbyterian Hospital) consists of a piece of small intestine, measuring 135 cm. in length. Thirty-three diverticula are present. They are all in close relation to the mesenteric border in their origin and pouch on either side beneath the mesenteric leaf (Fig. 1).

In nearly every case a large vein, and sometimes an artery, may be seen coursing over the pouch of the diverticulum. The intestine has

been preserved unopened, so that no description of the diverticula from the inside is given. They measure from 0.25 cm. to 6 cm. in diameter, all being of a globular shape.

Microscopically, a transverse section through one of the diverticula shows a small saccule opening into the gut through a narrow

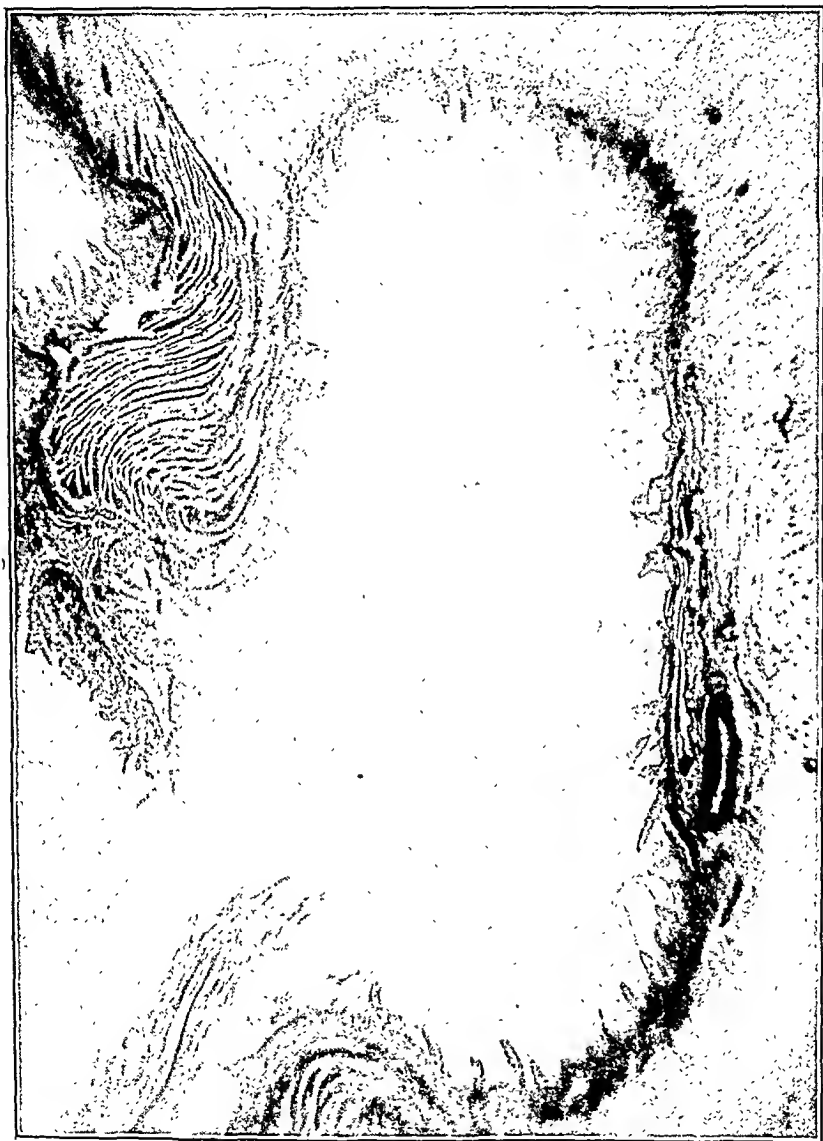


FIG. 11.—Microscopic section through a diverticulum, showing the artery and vein in the wall of the sac. (Case XVIII.)

opening. The wall of the sac is composed chiefly of the inner and outer coats of the gut, the longitudinal fibers of the muscularis extending down for only a short distance on either side as a thin strip. The mucosa and submucosa show no changes. The cross-sections of two large vessels—a vein and an artery—occur in the subserosa of fundus (Fig. 11). The serosa shows no perceptible thickening. A

longitudinal section through another diverticulum presents a very similar appearance. The muscularis, however, in this case, stops abruptly on either side of the neck of the saccule. A large vein is found in the subserosa. The intestine adjacent to the diverticulum in both cases appears normal.

SUMMARY OF REPORTED CASES. Four patients showed symptoms for which they underwent operation. Of these, three suffered from chronic symptoms, and were cured by operation; one suffered from acute obstruction, and was cured by operation. Eight specimens were obtained from autopsies on persons dead from causes not connected with the diverticula, and in none of them had any symptoms relative to this condition ever been present. The remaining six specimens were found in the museums, and no clinical or post-mortem data were obtainable.

Sex. Of thirteen cases in which the sex is given, ten were female and three were male.

Age. The two youngest cases were six and seven years old, respectively. Three were under thirty years of age, and six were over fifty. The ages of those giving clinical symptoms were between twenty-two and forty-three, thus demonstrating that neither the diverticulum nor its inflammation is solely a disease of advanced life.

The number of diverticula in each case was as follows: The least was one and the most was thirty-three, with an average of about ten. Location: Of the eighteen cases, seven involved the descending colon, or the sigmoid, or both; three involved the ascending colon; one involved the cecum; two involved the transverse colon; two involved the "colon," the particular portion not being given; four involved the small intestine, one of which was in the duodenum; one involved the wall of a Meckel's diverticulum. In five out of the eighteen cases, the diverticula occurred in the small intestine. In all but one of these the diverticula were in close relation with the mesenteric line. None of those in the large intestine was so placed, the greatest number, eight cases, being found between a lateral tenia and the mesentery. Only one was found in the convex border of the intestine. In three of the five cases occurring in the small gut, there appeared to be a definite relationship between the diverticula and the mesenteric veins. No such connection could be established in any of the cases occurring in the large gut. In only one was there any evidence that a venous congestion in the inferior mesenteric veins had been present during life, while in eleven this was absent. This is in direct opposition to the findings of Graser. In the remaining six no information on this point was obtainable.

Of the fifteen cases from which microscopic sections were cut, twelve showed more or less muscularis about the particular sac studied. In the other three cases, the fundus of the sac was composed of only the inner and outer coats of the gut, the muscularis terminating abruptly at the neck of the sac. In five of the twelve

cases in which a muscularis was demonstrated, both muscular layers were present. In five others, only the longitudinal coat survived. In the remaining two cases, only the circular coat could be demonstrated. By means of the Van Gieson's stain, traces of atrophied muscularis were found in several instances in which it had been overlooked in hematoxylin-eosin preparations. As a rule, we have found that the larger the diverticulum, the thinner and more atrophied is the muscularis. The circular layer is generally the first to disappear.

CONCLUSIONS. 1. Diverticulum of the intestine is a common condition.

2. The large bowel is the most frequent site, particularly the descending colon and the sigmoid.

3. Children and young adults are subject to diverticula, and to the secondary changes occurring in them.

4. All diverticula are probably true in their incipency. The false characteristics are the results of their growth.

5. An inherent weakness existing in the muscularis is probably an important factor in the etiology of diverticula. In the small intestine this weakness appears to exist along the mesenteric attachment.

6. Diverticula undergo the same pathological changes as the appendix veriformis, and give rise to much the same general symptoms. These pathological changes are not uncommon.

We wish to express our thanks to Dr. Opie for the material from the museum of the Presbyterian Hospital; to Dr. Norris and Dr. Pappenheimer, for specimens from the Bellevue Hospital Laboratory; to Dr. Crowel, for specimens from the museum of the University and Bellevue Medical School; and to Dr. Moschowitz, for permission to include his interesting case in our series. We are also indebted to Drs. Leaming, Jachs, Agnew, and G. M. Smith, for photographs of the specimens.

SKIN RASHES IN TYPHOID FEVER.

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THE usual cutaneous manifestation seen in typhoid fever is the presence of rose spots in the form of a maculo-papular eruption appearing on the abdomen. The lesions are pale red at first, later become darker, and appear about the end of the first week, coming out in successive crops. They are usually few in number, but in some patients form a profuse eruption, covering the entire body and extremities, and are occasionally seen on the face. Sometimes the lesions are capped by tiny vesicles, at other times they are hemorrhagic. The other cutaneous lesions seen in typhoid form a very

interesting group. Among these may be mentioned herpes, urticaria, sudamina, desquamation, erythema, erysipelas, purpura, furunculosis, abscess, carbuncle, impetigo, onychia, infected sebaceous cyst, decubitus, tache bleuâtre, and lineæ atrophicæ. The following description of these conditions is based on a review of the literature, and on a study of their occurrence in 1230 cases of typhoid fever, occurring in the medical services of Drs. Powell, Lowman, Upson, Cushing, and Hoover, at Lakeside Hospital; to these gentlemen I am indebted for the privilege of making this report.

Herpes were observed in 12 cases. In 8 cases they appeared on the lips during the first week of the disease. In the other 4 cases the herpetic eruption appeared late in the course of typhoid and in various regions of the body. In 1 case, a female, aged thirty-two years, a number of vesicles appeared on the forty-fourth day of her illness, a short distance outside the external canthus of her left eye and also directly above this near the hair line. Another patient, a boy, aged fifteen years, on the thirty-third day of the disease, had a small patch of herpes develop on the lower part of his chin, to the right of the median line. The third case, a male, aged fifty-two years, was afflicted with herpes over the left malar bone on the thirty-first day of his typhoid. In the fourth case, a male, aged twenty-nine years, symmetrical patches of herpes appeared on the inner and outer side of each knee, the patches on the left being more extensive. Many think that the presence of herpes labialis excludes the diagnosis of typhoid fever. That this is incorrect is shown by the 8 cases mentioned above. McCrae¹ found 20 cases of herpes in his series of 1500 patients with typhoid fever. Zinn² met this condition in 5 per cent. of 190 cases in the hospital at Nuremberg.

Urticaria was present in 21 cases. In some the urticarial eruption developed as a few scattered wheals on the chest or abdomen, preceding the appearance of the rose spots; in other cases it appeared later in the disease. Occasionally the lesions may cover the greater portion of the body and extremities. Miller³ found urticaria in 2 cases in his series of 350 patients. It was formerly thought to be due to the administration of quinine, but this drug was not used in any of our patients.

A miliary eruption of sudamina is a very frequent occurrence in the third and fourth week of typhoid, when sweating is profuse. They are due to the retention of sweat drops beneath the epithelial layer of the skin. De Lacaze⁴ believes that sudamina possess a definite prognostic significance. When they appear in the third or fourth week they indicate the entrance into active convalescence. My experience confirms this statement. They are usually seen on

¹ Modern Medicine, edited by Osler and McCrae, ii, 117.

² Münch. med. Woch., 1895, xlii, 486.

³ International Clinics, vol. iii, Sixteenth Series, p. 60.

⁴ Revue de méd., 1887, p. 275.

the chest and abdomen and in some cases present a striking appearance as though the skin was covered with tiny drops of water. Sudamina were present in 11 of a series of 100 cases in which a careful watch was made for this condition. Sometimes as a result there is profuse desquamation.

Quite extensive desquamation of the skin was noted in 83 patients. Riesman⁵ has classified desquamation under the following heads: (1) Following vesicular rose spots, (2) as a result of sudamina, (3) an atrophic change analogous to shedding of hair, which usually appears in cases with severe fever. To this I would add a fourth, which would include those cases of desquamation which follow an erythematous eruption in typhoid. Rolleston⁶ has reported a remarkable case of desquamation of the skin in large flakes in typhoid fever in a boy, aged ten years, who, on the fourteenth day of illness, had peeling of the skin off the thorax, thighs, and abdomen in flakes the size of a shilling. His heels and toes peeled in small scales. No cause for the peeling could be ascertained. Diehl⁷ has reported an interesting case of exfoliative dermatitis in a male, aged eighteen years, who, during convalescence from an attack of typhoid fever, had a rash, consisting of minute, pin-head sized, bright red papules, appear on the wrists, and later spread to the dorsal surface of the hands and forearms up to the elbow. Later it spread to the feet, legs, and body. Intermingled with these lesions were a number of blebs the size of a half dollar. Desquamation followed in the order in which the eruption appeared.

Of the accidental skin rashes in typhoid, probably none has received as much attention as the erythemas, because of the close resemblance at times to scarlatina and the resulting difficulties in diagnosis. The first to call attention to the scarlatiniform erythema in typhoid was Murchison,⁸ who stated that in many cases of enteric fever the appearance of the rose spots is preceded, for two or three days, by a delicate scarlet rash, all over the body, disappearing on pressure. He mentions the fact that Jenner relates an instance in which this rash coexisted with slight sore throat, and the disease was mistaken for scarlet fever. Murchison states that several similar instances had come under his own observation, and even goes so far as to assert that scarlet fever appears to predispose to typhoid fever. Various other writers—Graves,⁹ Ohmann-Dumesnil,¹⁰ Moore,¹¹ Osler,¹² Griffiths,¹³ Russell,¹⁴ Fisher,¹⁵ and Da Costa¹⁶—have called

⁵ AMER. JOUR. MED. SCI., January, 1904.

⁶ Trans. Clin. Soc., London, 1889-1890, xxiii, 84.

⁷ Jour. Cut. and Genito-urin. Dis., 1898, xvi, 222.

⁸ Treatise on Continued Fevers of Great Britain, second edition, 1873, p. 515.

⁹ Medical Record, 1890, xxxvii, 118

¹⁰ Jour. Amer. Med. Assoc., 1890, xv, 164.

¹¹ Dublin Jour. Med. Sci., 1888, lxxxvi, 497.

¹² Johns Hopkins Hospital Reports, "Studies in Typhoid Fever," i, ii, iii, 471.

¹³ Lancet, 1893, ii, 1307.

¹⁴ Lancet, 1896, i, 766.

¹⁵ Brit. Med. Jour., 1893, i, 704.

¹⁶ Trans. Assoc. Amer. Phys., 1899, xiv, 89.

attention to the presence of a scarlatiniform erythema in typhoid. The bright red eruption may be limited to the flexor surfaces or it may cover the entire body, as in one of my cases. As a rule, there is no involvement of the throat, although Da Costa has reported a case in which there was some soreness and redness of the throat. This, as a rule, has no particular significance, as occasionally the onset of typhoid is ushered in by tonsillitis. Whipple¹⁷ has recorded a similar case in a male, aged thirty-six years, who, on the fourteenth day of his illness, developed a sore throat, with a bright erythematous eruption over the entire trunk and a less definite rash on the legs and arms. He died four days later, but his erythema had almost entirely faded before his death. Moore attributes the development of the scarlatiniform eruption, when it appears early in the course of typhoid, to a reactive inhibition of the vasomotor system of nerves; when it appears in the third week to a septicemia or secondary blood poisoning. The diffuse erythemas are usually present in the severe toxic cases, and it seems to me that they are due to an attempt of nature to get rid of the toxins through the skin; these irritate the skin, producing an erythema just as one sees in uremia, septicemia, or in cases of intestinal auto-intoxication. In reviewing the cases of this character published in the literature, one is surprised at the number that are fatal. Seven of the cases in our series showed erythema; in one it was of the type of erythema multiforme, which developed on the back and about the buttocks. Osler¹⁸ has reported one case of erythema nodosum, in which the characteristic eruption on the legs appeared on the fifteenth day of typhoid fever.

A number of cases have been reported in which true scarlet fever has developed during the course of typhoid. Sequeira¹⁹ and Caiger²⁰ each have met with two such cases, and Payne²¹ with one case. Griffiths²² had the remarkable experience of seeing four children in one family who were attacked by both diseases, the onset of both fevers being almost simultaneous. Cosgrove²³ has reported five cases in which the two diseases occurred in the same individual. Carmichael²⁴ mentions the case of a boy, aged six years, who, after suffering from scarlet fever and going on to the stage of desquamation, continued febrile from oncoming typhoid fever. Coombs²⁵ and Gabe²⁶ have each reported a similar case.

Closely allied to the cases of typhoid complicated by erythema are those which show a rash resembling measles. Instances of this kind have been reported by Beevor,²⁷ Neumann,²⁸ and Da Costa. Beevor's

¹⁷ Trans. Clin. Soc., London, 1882-1883, xvi, 150.

¹⁸ Johns Hopkins Hospital Reports, "Studies in Typhoid Fever," p. 473.

¹⁹ Brit. Med. Jour., 1891, i, 586.

²⁰ Lancet, 1894, i, 1137.

²¹ Ibid., 1894, p. 1264.

²² Ibid., 1893, ii, 1307.

²³ Brit. Med. Jour., 1897, i, 29.

²⁴ Lancet, 1894, i, 246.

²⁵ Brit. Med. Jour., 1897, vol. i.

²⁶ Ibid., p. 848.

²⁷ Ibid., 1883, i, 956.

²⁸ Centralbl. f. klin. Med., 1890, xi, 465.

patient was a probationer nurse, who, on the third day of her typhoid, had a morbilliform eruption appear on her feet, legs, chest, and upper extremities. There was no coryza or conjunctivitis, nor was the arrangement of the lesions crescentic. These two facts and the appearance of the eruption on the body in a different sequence from that seen in measles, would assist in making a correct diagnosis. In this case the rash gradually faded and was not followed by desquamation. In Neumann's patient the morbilliform eruption appeared in the third week; Da Costa's two cases also developed the rash late in the course of typhoid. The co-existence of typhoid fever and measles in the same patient has been reported by Chrystie,²⁹ Matiegka,³⁰ Ringer,³¹ Ringwood,³² and Da Costa. In the two cases reported by Da Costa there was a definite history of exposure to measles, the eruption showed the characteristic crescentic arrangement, and was preceded by coryza and conjunctivitis.

In six cases purpura was noted. One of these, a girl, aged eighteen years, developed on the twenty-third day of typhoid a purpuric spot on the second toe of the left foot; this was followed by a number of petechiæ on the outer side of both feet. A few days afterward she had hematuria and menorrhagia. She succumbed from weakness and toxemia two weeks later. Four other patients had, in the third and fourth week of the disease, petechial spots appear on the lower extremities. I have not included here the cases in which there were hemorrhagic rose spots; this condition is not very uncommon. The sixth case of purpura is so remarkable that I shall give it in detail. This patient, a female, aged eighteen years, was admitted to Lakeside Hospital May 9, 1903, with a typical history of typhoid fever, with rose spots, enlarged spleen, and a positive Widal reaction. On the sixth and seventh days after admission she had two copious intestinal hemorrhages. At the same time several large purpuric spots appeared on the abdomen—one just above the pubis and another at the site of an old appendiceal scar being much larger than the others. There were also a few petechiæ over the anterior surface of the left ankle, one over the second toe of the left foot and a small ecchymosis over the great toe of the right foot. The patient complained of some burning in the ecchymotic areas of the abdomen. This was relieved by the application of hot compresses. In the course of a few days the ecchymoses on the abdomen became much darker in color, and at the end of a week a central slough had separated, leaving a ragged ulcer in the region of McBurney's point, and another just above the pubis (see Fig. 1). The patient died three weeks after admission from toxemia.

Such superficial gangrene of the skin is very rare. Taupin³³ mentions a case of sloughing of the thighs, sacral region, knees, elbows,

²⁹ Univ. Med. Mag., December, 1888.

³⁰ Prager med. Woch., September 25, 1889.

³¹ Lancet, June 30, 1889.

³² Ibid., July 7, 1889.

³³ Jour. des Con. méd.-chir., 1839, No. 7 (quoted by Hare and Beardsley, p. 177).

and of the face, in a child with typhoid fever. The skin became violaceous in appearance, and mortified, and this was accompanied by increase in the delirium. Hare and Beardsley³⁴ have reported a case in which the gangrene developed on the inside of the left calf of a girl, aged nineteen years, who had suffered some days before from a series of profuse hemorrhages. Two brown ecchymotic spots formed on the heels, but did not slough. The separation of the slough was accompanied by loss of power and sensation in the anterior part of the leg, evidently from peripheral neuritis. A very extraordinary series of ten cases of gangrene of the skin has been reported by Stahl,³⁵ which occurred in soldiers. Two cases in children have been reported by Jacobi,³⁶ and Abt.³⁷ McFarland³⁸ has also reported a series of patients in which gangrene of the skin resulted from typhoid fever. Nicholls³⁹ has recorded four cases in which late in the disease the hemorrhagic diathesis developed, the patients having hemoptysis, hematemesis, and hemorrhages from the bowels. A somewhat similar instance is reported by Hughes and Levy.⁴⁰

In four patients a pemphigoid eruption was present. In one, a girl, aged seven years, a single large bleb appeared on the dorsum of the right hand. Cultures from the contents of the bleb showed *Staphylococcus pyogenes aureus*. In a second case a large bulla, surrounded by a red areola, appeared on the left shin, below the knee. The third case had two bullæ, one on the dorsum of the left hand, the other in the left axilla. In the fourth patient there were two bullæ, the size of a dime, on the right buttock. In all these patients the eruption appeared in the third and fourth week of the typhoid. Osler⁴¹ has reported one similar case.

Two cases of erysipelas occurred in this series. This complication is seen late in the course of a typhoid, when the resistance of the patient is very much reduced. The first patient, a man, aged twenty-seven years, developed during the third week of his typhoid an erysipelatous eruption on the cheeks, with a marked rise in temperature, chills, and leukocytosis. The eruption spread over the face and scalp, and after running its usual course, he recovered. The second patient, a male, aged twenty years, in the fourth week of typhoid fever, following a purulent otitis media, was afflicted with erysipelas, beginning over the right parotid. It spread so as to involve the face and the greater part of the scalp. He made a good recovery.

Curschmann⁴² claims that the principal reason that erysipelas is

³⁴ Typhoid Fever and Exanthemata, second edition, 1909, p. 177.

³⁵ Quoted by Hare and Beardsley, p. 178.

³⁶ Arch. Péd., December 15, 1899.

³⁷ Jour. Amer. Med. Assoc., 1901, xxxvii, 445.

³⁸ Quoted by Hare and Beardsley, p. 179.

³⁹ Montreal Med. Jour., June, 1906.

⁴⁰ Arch. de méd. et de phar. mil., August, 1892 (quoted by Hare and Beardsley, p. 179).

⁴¹ "Studies in Typhoid Fever," Johns Hopkins Hospital Reports, p. 476.

⁴² Nothnagel's Encyclopedia of Practical Medicine, Typhoid and Typhus Fevers, 1901, p. 324.

more common late in the course of typhoid, and during convalescence, resides in the fact that at this time bedsores and other ulcerative processes form a favorable starting point for this complication. Among 1420 cases Liebermeister⁴³ saw erysipelas occur in ten. Of these, eight had facial erysipelas; in the other two, the disease developed about bedsores. Griesinger⁴⁴ noted fatal erysipelas in 2 per cent. of 500 cases observed at Zurich. Hare and Beardsley⁴⁵ have reported three cases of facial erysipelas in women, complicating typhoid, that occurred within a period of six weeks of each other in the wards of St. Agnes' Hospital. The first case was separated from the second by an interval of five weeks, and the second from the third by less than a week. They were all in the same ward but occupied beds at least twenty feet apart. They all made a good recovery. In one there was chronic suppuration of the middle ear. In the collected statistics of Hare and Beardsley erysipelas was found recorded sixty-four times in 3910 typhoid patients, which is about 1 to 61, the proportion given by Gerente. Other interesting cases of this complication have been described by Thielman,⁴⁶ Berthoud,⁴⁷ Armieux,⁴⁸ Freudenberger,⁴⁹ Potain,⁵⁰ and Martine.⁵¹ Silverstrini⁵² has reported two cases of facial erysipelas in typhoid fever, in which the inflammation was found to be due to the bacillus of Eberth, and not to streptococci.

There were twelve cases of bedsores. Their most frequent site is over the sacrum, although they may be found over the occiput, the vertebral spines, the spine of the scapula, the great trochanter, the tuberosity of the ischium, and even over the heels. In some of our cases the bedsores were present on admission, owing to lack of careful nursing at home. In others the patients had severe intestinal hemorrhages, so that for a few days they were moved as little as possible. It seems to me that often more harm is done by keeping the patient in the dorsal position after a hemorrhage than would result from careful movement, because of the frequent development of bedsores. In very toxic cases they are likely to occur because of the involuntary micturition and defecation.

Under the heading of septic conditions of the skin there were noted in this series 45 cases of furunculosis, 2 of carbuncle, 5 of onychia, 9 of abscess, 1 of impetigo, and 1 of infected sebaceous cyst of the head. These cutaneous infections appear in the late stages of typhoid, when the course of the disease has been much protracted and when the patient's vitality has been considerably reduced. Edsall⁵³ has described a series of cases of typhoid in which furunculosis occurred

⁴³ Quoted by Hare and Beardsley, p. 253.

⁴⁴ Quoted by Curschmann in Nothnagel's *Encyclopedia, Typhoid and Typhus Fevers*, p. 325.

⁴⁵ *Typhoid Fever and Other Exanthemata*, second edition, Lea & Febiger, 1909, p. 253.

⁴⁶ Quoted by Hare and Beardsley, p. 257.

⁴⁷ *Ibid.*, p. 25S.

⁴⁸ *Ibid.*, p. 257.

⁴⁹ *Ibid.*, p. 258.

⁵⁰ *Ibid.*, p. 259.

⁵¹ *Ibid.*

⁵² *Ibid.*

⁵³ *Univ. Penna. Med. Bull.*, March, 1904.

about the buttocks, the infection evidently being spread by the bedpan. I have been unable to establish a similar method of infection in any of our cases. Carbuncles were present in two cases, in both of which they occurred during the stage of convalescence. In the one instance the carbuncle was situated on the outer side of the left leg, a short distance above the ankle; in the other, on the back in the lumbar region. Hare and Beardsley⁵⁴ mention one case in which the patient had a carbuncle on the back, which appeared about the twelfth day of an attack of typhoid, and persisted during a relapse and well into the second convalescence.

There were five cases of onychia; with one exception, these were in children. They are very painful, but heal readily with proper treatment. Abscesses were present in nine patients; these were in various situations over the lower third of the tibia, in the ischio-rectal fossa, in the vulvo-vaginal, gluteal, axillary, alveolar folds, in the groin, and in front of the right ankle. They are usually subcutaneous, but in some cases they may extend into the muscles. Impetigo was seen in one case. In another patient there was an infected sebaceous cyst of the head.

Another form of skin manifestation in typhoid is the *tache bleuâtres*, which Hare and Beardsley state were first described as occurring in typhoid by Piednagel, in 1837. The majority of observers will agree with Hewetson,⁵⁵ that they are usually, if not always, associated with the presence of pediculi. I have seen them in dispensary patients suffering from conditions other than typhoid, but in whom pediculi were present. They are steel-gray spots, 4 to 10 mm. in diameter, of irregular outline, and most abundant about the chest, abdomen, and thighs.

A very unusual lesion of the skin in typhoid is the development in children and young adolescents, especially when the disease has run a very long course and when the growth in height of the patient has been very rapid, of *striæ patellares*. A very interesting case of this kind came under my observation. A boy, aged fourteen years, was admitted to Lakeside Hospital May 16, 1906, suffering from a severe attack of typhoid fever. The disease ran a very long course, the complications being bronchitis, intestinal hemorrhage, and relapse. During his prolonged stay in bed he became very emaciated. He lay the greater part of the time with his knees slightly flexed and the toes extended, so that the skin was stretched. On July 2 he called our attention to some reddish scars, which were irregularly situated, in front of his knees and ankles, and appeared as if a superficial incision had been made, leaving the edges gaping open. On the anterior surface of the lower third of the leg there were in all nineteen of these scars, irregularly placed, the lowest being on a

⁵⁴ Typhoid Fever and Other Exanthemata, second edition, 1909, p. 177.

⁵⁵ Johns Hopkins Hosp. Bull., v, 19.

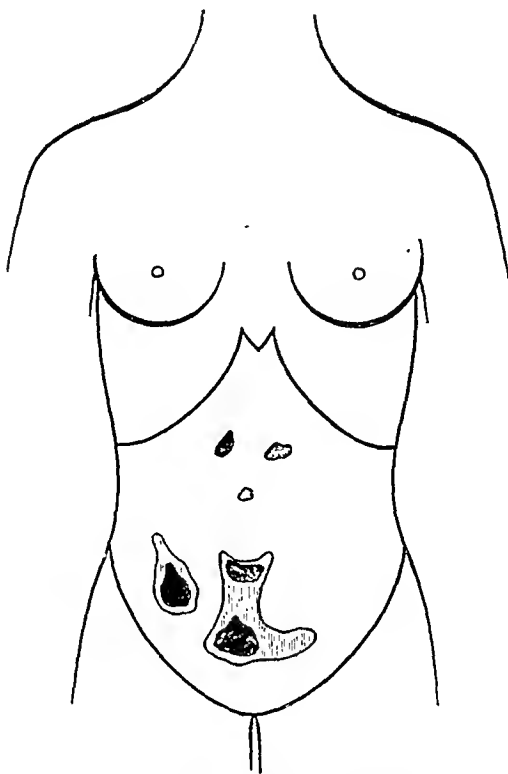


FIG. 1.—Showing the areas of ecchymoses on the abdomen. The darker areas represent the ulcers after sloughing.

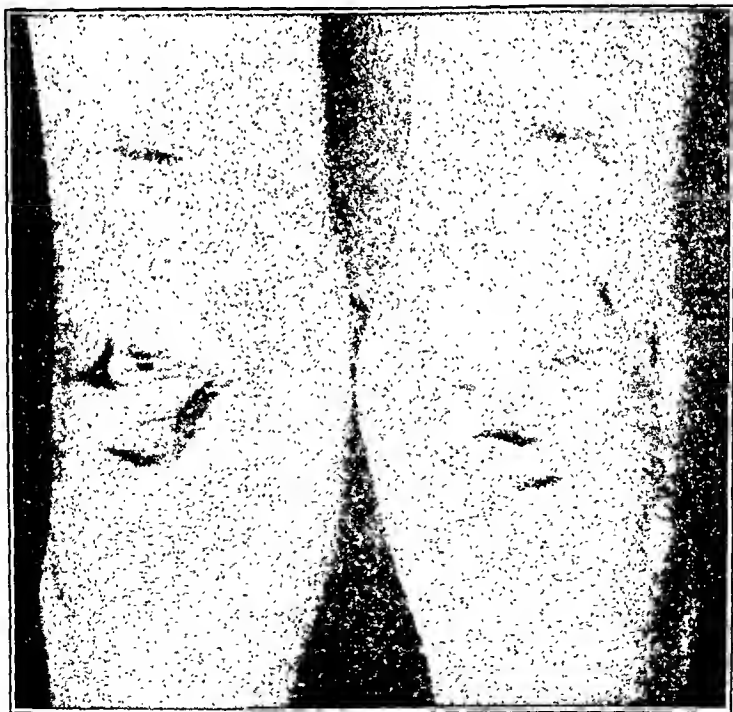


FIG. 2.—Showing the striae about the knees.

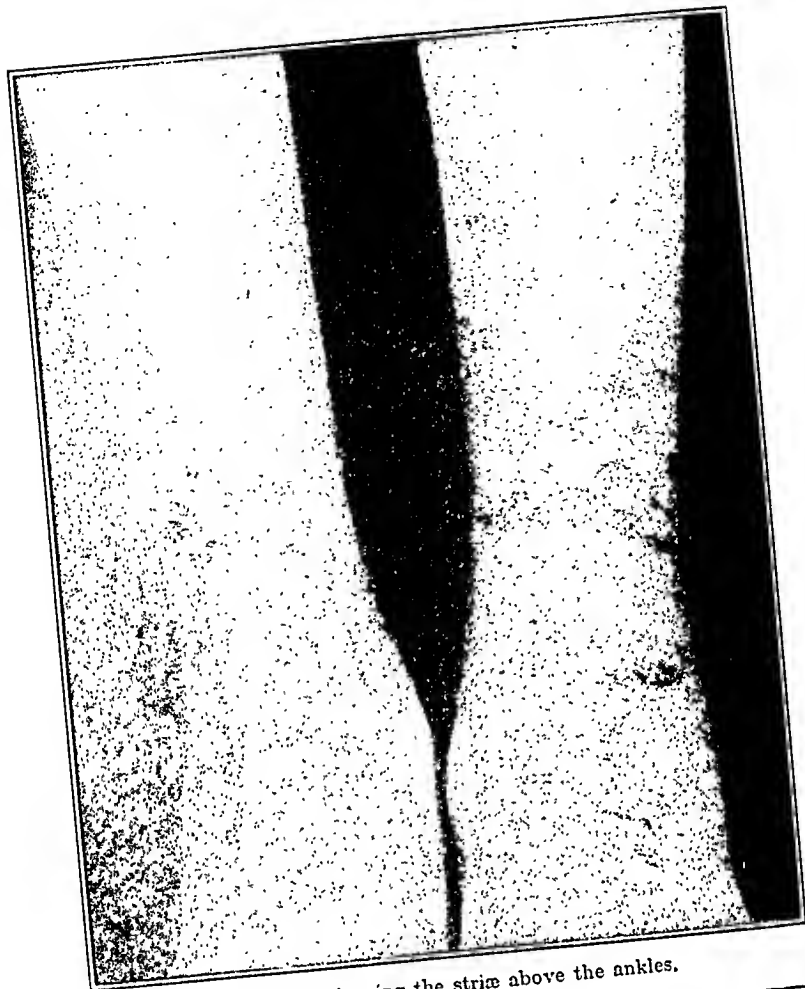


FIG. 3.—Showing the striæ above the ankles.

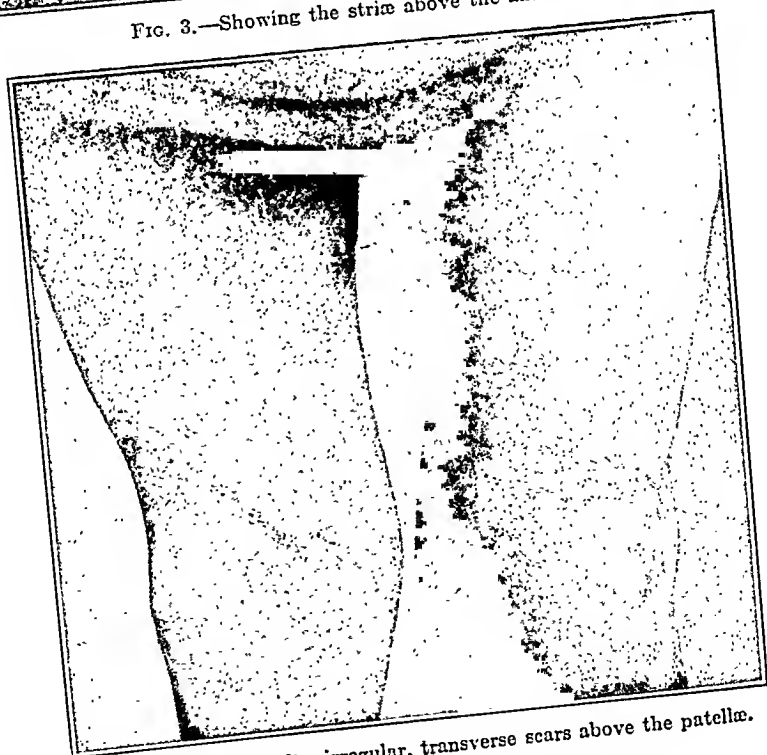


FIG. 4.—Showing white, irregular, transverse scars above the patellæ.

level with the tip of the internal malleolus, the highest 14.5 cm. above this point. They lay transversely, and varied in length from 1 cm. to 3 cm. The average width of the striæ was 9 cm. Directly over the centre of the patella, and extending transversely, was one of these striæ, 2.5 cm. in length, 0.25 cm. in width. In the median line over the anterior surface of the lower part of the thigh, 7 cm. above the transverse scar over the centre of the patella, was a linear transverse scar, 2×0.5 cm. in size. Three others of varying length were situated below the one over the middle of the patella. In all there were twenty-four of these lesions on the left extremity. On the right there were eighteen striæ, situated in positions similar to those on the left, making a total of forty-two. The positions of these striæ are seen in the accompanying pictures (Figs. 2 and 3). They were a delicate pink color, in marked contrast to the surrounding skin, and were painless, causing the patient no inconvenience whatever. There were no sensory disturbances in this case. During the patient's prolonged stay in bed he grew about four inches in height, and it seems to me that the most reasonable explanation of the striæ is the stretching of the skin from the rapid growth, the vitality of the tissues being much lowered. The occurrence of the lesions in the situations referred to was due to the fact that here, from the partially flexed position of the knees and the extension at the ankles, the skin was on a tension, and, besides, the growth is very rapid at the epiphyses of the long bones.

After seeing this case, I inspected the knees, for the presence of these scars, of every patient admitted to the medical wards. Four months later I was rewarded by finding them in front of the knees of a woman, aged forty-two years, admitted for a chronic condition, and who, when fifteen years old, had been afflicted with a severe and prolonged typhoid. She had a series of white, irregular, transverse scars just above the patellæ (Fig. 4).

This unusual condition of patellar striæ was first described by Wilks⁵⁶ in the case of a lad who had been confined to bed for the greater part of the time for six years, with disease of the knee-joint. He had three transverse stripes of a pale color in front of his knee, appearing as if a piece of skin had been removed and the edges never approximated, or as if a single incision had been made and the wound, gaping open, had been filled up with some loose texture. Over the instep of the right foot were several transverse scars lying parallel with one another. Similar but less distinct scars were found on the dorsum of the left foot. No mention was made of typhoid fever in this case. Bradshaw⁵⁷ records the case of a girl, aged thirteen years, who had a severe attack of typhoid, with two relapses. On the ninety-eighth day, because of some difficulty in walking, he

⁵⁶ Guy's Hosp. Reports, vii, 1861.

⁵⁷ Liverpool Medico-Chirurgical Journal, July, 1888.

was led to examine the lower extremities, and found over the anterior surface of the lower third of the thighs and the patella five or six horizontal markings, the longest reaching to about one-third the circumference of the limb, and being about half an inch in width. The smallest was under an inch in length and narrow in proportion. On flexing the knee the pink portions became smooth and shiny. On placing the finger on the markings a distinct depression was felt, as if there were a crack in the true skin, filled up with a thin layer of cuticle. There were no sensory disturbances in this case.

Shepherd⁵⁸ records the presence of these striæ in a boy, aged fifteen years, with typhoid, which ran a long severe course, and was complicated by double parotitis, with paralysis of the right facial nerve, paresis of the lower limbs, and fits of an epileptic character, with a mild form of dementia. Two months after admission he had well marked striæ over both patellæ and above both knees, purplish in color and elliptical in shape, tapering to a fine point at each end. The largest was six inches in length and half an inch in breadth at the middle. Troisier⁵⁹ has noticed this complication in young adults and children. Northrup⁶⁰ describes and figures the striæ above the knees in a lad, aged seventeen years, after a protracted course of typhoid. He said they were at first reddish, like "welts made by a switch." Fisher⁶¹ has recorded a case in which the striæ developed above the knees after typhoid in a girl, aged thirteen years. Sir Dyce Duckworth⁶² records unilateral striæ on the thighs in a patient, aged fifteen years, following typhoid. In this case there was accompanying hyperesthesia in the distribution of the external and middle cutaneous nerves. Köbner⁶³ reports two cases in girls, aged thirteen and fourteen years, with the characteristic lesions in front of the knee. One of these cases he saw twenty-three years afterward, and she was found to have broad white scars at the site of the lesions. Other cases of patellar striæ following typhoid have been described by Barie,⁶⁴ Kaposi,⁶⁵ Langer,⁶⁶ Gubler,⁶⁷ Bouchard,⁶⁸ Nonne,⁶⁹ and Bunch.⁷⁰

As seen from the descriptions given above, the most frequent site for these lesions is over the lower part of the anterior surface of the thigh and in front of the patella, though they may occur in other parts of the body and in other conditions besides typhoid. This Pflügge⁷¹ has noticed them, after typhus fever, occurring on the abdomen, where there had been no distention of the parietes. They

⁵⁸ Trans. Amer. Dermat. Assoc., 1890, xiv, 23.

⁵⁹ Bull. et mem. de la Soc. méd. des hôpitaux, 1889, No. 12.

⁶⁰ Trans. Assoc. Amer. Phys., 1903.

⁶¹ Brit. Jour. Dermat., 1893, p. 357.

⁶² Sem. méd., 1888, p. 259.

⁶³ Anzeiger der k. k. Gesell. der Aerzte in Wien, No. 28, 1879.

⁶⁴ Quoted by Bunch, Brit. Jour. Dermat., 1905, xvii.

⁶⁵ Ibid.

⁶⁶ Ibid.

⁶⁷ Münch. med. Woch., 1904, 482.

⁶⁸ Münch. med. Woch., 1904, p. 928.

⁶⁹ Diseases of the Skin, Hebra, vol. iii, 262.

⁷⁰ Brit. Jour. Dermat., 1905, xvii.

⁷¹ Zeitschr. f. die Staatsarzneikunde, 1861, xv, 369.

have been noted even on the arm and over the knuckles of the hand (Barie). Bucquoy⁷² has stated that in boys these lines may have no special areas of distribution, but in girls the breasts and crests of the ilium are the places where they usually appear. With this statement I cannot agree, as no such cases have occurred in over 1300 cases of typhoid treated at Lakeside Hospital. My own case is the only one in which extensive lesions have been described over the anterior surface of the lower part of the leg and in front of the ankle. Striæ have also been described in phthisical patients and in children suffering from colitis. They always leave permanent scars because the true skin is affected.

Many causes have been given for their appearance. Barie, because there was an accompanying herpes zoster in his case, considers this conclusive of their nervous origin. In support of this Sir Dyce Duckworth found hyperesthesia of the skin in the distribution of the middle and external cutaneous nerves in his case. The most reasonable and probable explanation is that given by Bunch and others, that they are due to the stretching of the skin from excessive growth of the long bones, either from want of pressure on the epiphysis or from a juxta-epiphyseal osteitis. Bunch states that the histological changes found consist in a diminution in the interlacing of the elastic fibers and a thinning of the white fibrous tissue. The elastic fibers show a parallel arrangement which has been brought about at the expense of the crossing transverse elastic fibers which have ruptured and retracted to the edge of the lesion. In the centre of the lesion, therefore, the total number of elastic fibers was less than that found in healthy skin, and those were more or less parallel to one another. At the edge of the lesion were the broken ends of the missing elastic fibers which had retracted, and the elastic tissue here appears denser than normal. In the pars reticularis of the corium these changes were best marked, and the more slender fibrils of the elastic network seemed to have suffered most. The branching fibrils which surround the sweat glands and hair follicles tend, no doubt, when dragged upon, to cause a deflection of these glands and follicles. Troisier and Menetrier⁷³ have also described an alteration in the course of the bloodvessels due to the same cause, but the sections of Bunch did not show this. In addition to these changes in the corium, there was slight thickening of the prickle cell layer, but the lesion was essentially one involving the corium more than the papillary layer and prickle cells. There was some round-cell infiltration around the bloodvessels. Kaposi, however, has examined the skin in those cases and found the epidermic layer and the mucous layer much atrophied. The papillæ had entirely vanished. Langer asserts that these lesions are not due to rupture but to disarrangement of the connective tissue. The connective tissue

⁷² Quoted by Hare and Beardsley.

⁷³ Arch. de méd. expér., 1889, p. 134.

bundles form rhomboid meshes which, when the integument is distended, stretch most readily in the long axis. He says the striæ are the result of violent stretching, the bundles in part becoming parallel and remaining in position.

EXTENSIVE SARCOMA OF THE HEART, INVOLVING THE BUNDLE OF HIS.

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WHATEVER be the real causation of the heart beat, and through whatever agency the rhythm of the heart is maintained, there is no doubt that recent studies of the anatomy of the heart itself have thrown considerable light on the subject, and the work of Tawara, His, Keith, and many others, has led one to believe that the explanation is nearing a solution.

Passing from the earlier authorities, whose views as to the heart's action were based on a belief that the blood itself, circulating through the chambers, was responsible for the individual beat, we were brought to consider the heart tissue as having some special function whereby the action, more or less automatic, was maintained in the absence of external control. When, however, the researches of anatomists and neurologists led us to see that ganglion cells and nerve fibers were present in abundance, the so-called neurogenic theory took its place as of paramount importance, and the heart's action was regarded as primarily subservient to the nervous mechanism of the body—the ganglia in the heart tissues originating the individual beats. Gaskell's researches, however, led to the myogenic theory, according to which the muscle cells themselves were possessed of a power independent of the nervous system, and by means of which stimuli originated and conduction and contractility were maintained.

When, however, ten years later (1893), Kent and His demonstrated special muscle bundles leading from the right auricle to the two ventricles, and with the further work of Keith, Flack, Erlanger, Gibson, Mackenzie, and many others, it was shown that the various functions of irritability, contractility, and conductivity depended in no small degree on the integrity of these muscular strands, a new

light was thrown on the whole subject of cardiac rhythm. In cases of myocardial disease with arrhythmia it was frequently demonstrated that the course of these fibers was disturbed by anatomical lesions of the bundles, and that when this existed the causation was attributable to this localized pathological change.

It remains, however, yet for physiologists and anatomists to determine whether or not the circulatory changes in functions thus induced are, after all, merely to be associated with muscular change, for in more recent times Pankul, working under Kronecker, found in the very bundles of His, running throughout their substances, nervous plexuses, injuries to which might readily account for any functional disturbance in which conductivity of the fibers exists.

Quite recently Wilson has again demonstrated that the atrio-ventricular bundle contains not only a special form of muscle fiber, distinct from the ordinary myocardium, but that it is an important and intricate nerve pathway, in which are found: (1) ganglion cells, (2) nerve fibers, and (3) nerve plexuses in close relation to the muscle fibers of the bundle.

It is obvious, then, that the exact relation of the bundles to cardiac rhythm requires more elucidation, and that while possibly, and even probably, the explanation lies in the altered condition of some tissues in these muscles strands, yet the whole explanation is not complete.

That such is the case is even more emphasized by an opposite state of affairs, that is, when, with more or less complete destruction of the bundles of His, no change in cardiac rhythm is observed. Such a case has come to our notice, and the interference of conductivity seems so probable that it may be cited as a very fair type of case which might illustrate the possibility of some other factor yet unknown which is either responsible for the control of the heart's action, or which, in the absence of the usual means of exercising this function, may take up the work and maintain the regularity of the heart's action.

Extracts from Dr. Tull's Case Report:

A bank clerk, aged twenty-three years, was admitted on October 19, 1907, to the Royal Victoria Hospital, complaining of swelling of the face, feet, hands, and scrotum, and of shortness of breath. He was well until the end of April, 1907, when he suddenly fainted while sitting at his desk. He was unconscious only a few seconds, and remained for five or six days. He had had a cough and spat up a fair quantity of mucus, but no blood. His doctor thought his right lung was involved (tuberculous), and sent him to a hospital, where he remained ten days, and then after one week at home, he went to the mountains. There he remained from the middle of May to July, 1907. While there he began to have urgent dyspnoea on slight exertion. If he walked upstairs he was very dyspnoeic, as also at night. With the dyspnoea there was cardiac palpitation, and his pulse varied from 100 to 140. No oedema or urinary disturbance

was present at this time, and his cough was less troublesome. He returned to Montreal in July and was seen by one of us (Dr. Martin), who examined him under the x-rays, and found a large intrathoracic tumor mass. He went home for the summer to Prince Edward Island to rest; he kept fairly well, except for attacks of dyspnoea, until August, when his throat began to swell, and he had some dysphagia. His doctor did some minor operation on his throat, which relieved this symptom. Toward the end of August his left arm suddenly became swollen, and has remained so, more or less, up to the time of admission. About this time, too, his face began to be swollen in the mornings; no headache was present. Three weeks later his feet began to swell, and were very œdematous at night. At this time he had pain down his sternum, and especially just to the right of it. His doctor thought there was fluid in his pericardium and blistered his precordium with some relief.

He has had a rapid gain in weight since the onset of the anasarca.

On admission the patient was a well nourished young man of twenty-three years. There was puffiness of the eyelids, with slight pitting over the forehead. Superficial veins marked, especially over the upper thorax, and upper right arm, to a less extent in the lower thorax. Relative dulness in second space above, laterally from 4 cm. to the right of the right sternal border, 25 cm. to the left. The dulness at the base was extensive, measuring some 12 cm. transversely. Absolute dulness in the third space above. At the apex both sounds were loud and clear. The liver dulness extended 8 cm. below the costal border in the right nipple line, and the large firm organ could be felt extending across the epigastrium. Penis and scrotum were tremendously œdematous.

Diary. October 21, 1907. Condition unchanged. Dyspnoea. No pain. Fluoroscopic examination showed an extensive mediastinal shadow. The heart was very large, and extended far into the left axilla. At the base the dulness measured 27 cm. transversely. The heart beat was wave-like, as if adhesions were present. The mediastinal shadow at the base was quite wide. No pulsation. The diaphragmatic movements could not be made out.

November 6, 1907. Exploratory puncture made in right chest, posteriorly, and a clear fluid withdrawn. Microscopic examination showed no unusual cells. Increasing anasarca.

November 20, 1907. The larynx was examined by Dr. Birkett, who said that there was thickening of the false vocal cords. General condition was much weaker, but his heart sounds remained strong and regular. General anasarca was increasing.

November 24, 1907. Right chest aspirated; 25 ounces of hemorrhagic fluid withdrawn. Dyspnoea partially relieved.

November 25, 1907. Fluoroscopic examination showed mediastinal dulness to have extended considerably. There was a dense shadow all over the right chest, and on the left side this extended

high up, as far as the second rib, and extended downward and outward into the left axilla, where the heart beat was seen, wave-like in character. Diaphragmatic movements were not visible. The patient died rather suddenly when moving about in a wheel-chair.

Clinical Diagnosis. Mediastinal neoplasm, sarcomatous; blocking of superior vena cava, with bilateral hydrothorax, especially on the right side; pulmonary oedema.

PULSE AND RESPIRATION.

		Pulse		Respiration.				Pulse		Respiration.	
		A.M.	P.M.	A.M.	P.M.			A.M.	P.M.	A.M.	P.M.
October	19	76	84	—	24	November	7	76	80	28	36
"	20	76	80	20	20	"	8	82	96	30	30
"	21	72	72	24	22	"	9	76	84	30	30
"	22	72	76	24	24	"	10	76	80	32	26
"	23	76	76	30	28	"	11	78	80	30	28
"	24	72	72	28	32	"	12	80	80	28	42
"	25	80	90	28	28	"	13	92	72	28	26
"	26	78	72	28	24	"	14	78	76	30	31
"	27	76	72	30	24	"	15	76	100	28	44
"	28	80	76	30	28	"	16	76	78	28	36
"	29	80	72	30	28	"	17	76	72	30	28
"	30	72	76	28	26	"	18	84	72	28	28
"	31	84	88	30	28	"	19	84	84	30	28
November	1	82	88	30	30	"	20	72	96	28	36
"	2	84	88	28	30	"	21	80	72	30	28
"	3	88	76	30	20	"	22	80	74	30	36
"	4	80	80	30	26	"	23	80	72	30	36
"	5	88	72	30	24	"	24	72	90	28	31
"	6	78	76	32	28	"	25	62	88	30	36

The patient's condition was closely observed during his stay in the hospital. The extensive venous stagnation which was present in the upper portion of the body indicated a blocking of the superior vena cava, and venous tracings were out of the question. The pulse rate, as is indicated by the table, did not attract attention to organic involvement of the heart, and was in no way indicative of a Stokes-Adams disease. The character of the heart beat as seen with the fluoroscope was wave-like, appearing as if the heart were impeded by adhesions. Arrhythmia of the auricles and ventricles could not be observed at any time.

AUTOPSY. Body that of a young man of large frame, with great oedema and hard brawniness of both arms, chest, abdomen, back, and both legs; scrotum enormously enlarged and hard; penis greatly oedematous; some oedema of face and neck; pupils equal, not contracted; body warm; beginning lividity of right side of chest, and of back; early bedsores on right hip; prominence of right hypochondrium; on section, tissues were very oedematous and bloody; much ascites with turbidity.

Neck. The jugular veins were thrombosed on both sides at the height of the larynx, and extending down from here the carotids and jugulars, just above the clavicle, became enveloped by tumor.

Below the clavicle the tumor formed one large mass behind the sternomastoids and enveloped, laterally, the organs of the neck; the tumor mass was three and one-half inches wide, solid, and of a light pink color; from here it passed into the mediastinum, lying in the middle line until it reached the pericardium, whose upper (visceral) surface was covered as far as the upper three-quarters of the heart. Parietal pericardium over apex was clear; the rest of it involved, circularly. The tumor mass also extended to the right over the parietal pleura, on to the diaphragm, the whole of which, on the right side, was infiltrated, the left being clear. The peritoneal surface of the diaphragm showed the tumor adherent to the liver. The arch of the aorta was surrounded by tumor, the descending thoracic aorta was not involved. This part of the tumor was a continuation of that affecting the parietal pericardium. The larynx was cedematous along the aryepiglottic fold; the trachea was not apparently compressed; although the tumor mass surrounded it at the bifurcation, the angle of the bifurcation was a mass of tumor tissue. Trachea and bronchi were clear. The thyroid was pale, showed colloid, not enlarged.

Thorax. On section of the thorax, the sternum was found adherent to the underlying white mass of fleshy consistence—new growth of mediastinum. The sternum was infiltrated and broke easily. On removal, the mass occupied the right two-thirds of the chest cavity. There were adhesions of the left lung posteriorly, on the upper lobe. The chest contained several hundred cubic centimeters of bloody fluid. There was excess of fluid in the pericardium, about 200 c.c.. The upper part of the heart, anteriorly, was covered by the pericardial growth. The right lung was completely adherent and could not be separated from the diaphragm.

Left Lung. The apex of the lung had tumor tissue growing over it, on the pleural surface, while some tumor tissue infiltrated the substance of the lung beneath. There were some adhesions of new growth over the pericardium where the infiltration of the lung was seen. The lung was gray, crepitated throughout, save for a small patch of hazel-nut size, at the anterior margin of the base; this, on section, appeared red, like an infarct, and was solid. No sign of tuberculosis in the lung. On section, the lung was dry and healthy looking.

Right Lung. Bullæ of œdema between pleural surfaces—cysts of pleura. The lung was solid, meaty, and much clear fluid could be expressed from it. There was no true infiltration of newgrowth in the organ. On section there was œdema.

Heart. This presented a remarkable appearance; the organ was covered by a cap of tumor over the entire right auricle and one-half of the right ventricle. This subpericardial mass also extended over the left auricle and slightly onto the left ventricle. In the left ventricle a solid mass of tumor could be felt within the muscle tissue.

On opening the left ventricle the interventricular septum was found to be a mass of newgrowth, save at its very apex; the septum was much thickened, averaging half an inch. On one side of the right ventricle the columnæ were partly obliterated by the huge plate-like growth of the tumor. The endocardium was everywhere smooth. All the valves appeared to be healthy, and no definite stenoses could be made out. The muscle tissue, apart from the tumor, was very pale. One of the coronary vessels was cut across and was seen to be embedded in tumor, and showed thrombus on its walls. A second cap of sarcomatous tissue was formed by the parietal pericardium, which, in its upper part, was fused into one solid mass of tumor tissue, continuous with the anterior mediastinal tumor. This extended in the form of a cap over the heart. The superior vena cava was firmly surrounded with newgrowth, while its lumen was blocked by a thrombus of some long standing. The main vessels of the neck, arising at the arch of the aorta, were completely surrounded and compressed by the new growth. The trachea and its main bronchi were embedded in a firm mass of white newgrowth. The walls of the pulmonary arteries were, at the hilum of the lung, infiltrated with tumor. The inferior vena cava, as it entered the heart, was surrounded by newgrowths, which extended into the substance of the right auricle and lined its cavity almost completely. The tricuspid valve had some of the newgrowth infiltrating its leaflets from the right auricle. The pulmonary valves were free, although their bases rested upon infiltrated tissue. The same was true of the aortic and mitral cusps.

Aorta. The wall was thin, with a few fatty plaques in the intima posteriorly. The glands about the aorta in the abdomen were œdematous, as was the rest of the tissue. The glands were, otherwise, not enlarged, nor showed tumor.

Abdomen. The peritoneum was clear and shiny. There were some few old adhesions between the gall-bladder and the transverse colon. The peritoneum contained over 750 c.c. of a yellowish and milky-looking fluid.

Œsophagus. Organ was clear throughout. There was no evidence of pressure from tumor in any direction. The tumor mass in the thorax lay anterior to the œsophagus.

Stomach. Contracted and congested throughout. The mucous membrane was clear and velvety. There was no sign of tumor mass in its walls. The duodenum was also congested. Mucosa was bile-stained.

Intestines. There was some congestion and œdema of the intestines, otherwise there was no change. The large intestine had the same characters as the small bowel. The appendix was free. The mesentery of the small intestine was œdematous, and, when cut into, exuded a milky fluid.

Rectum. Clear.

Liver. 1920 grams, 26 x 19 x 8 cm. Organ was of good size; capsule was smooth and tense; organ congested. There was œdema of the gall-bladder, which contained a blood-stained looking bile. The inferior vena cava, as it passed behind the liver, was encircled by tumor mass, which also infiltrated the openings of the hepatic vein. Between the suspensory ligaments the tumor mass lay beneath the capsule of the liver, and infiltrated the liver substance itself. On section, the tumor was found to infiltrate the upper border of the liver, which lay against the diaphragm, for a depth of 4 cm. Liver substance in this area was completely obliterated and looked like bone marrow. Save for this continuous infiltration, the liver contained no other tumor masses. The left lobe of the liver was free. The liver substance itself had a nutmeg character.

Pancreas. 18 cm. long. Organ was pinkish-gray in color; lobules were distinct; the organ was healthy looking.

Spleen. 185 grams, 12 x 4 x 3 cm. Organ was dark in color, very firm, and of cardiac nature; otherwise it showed no changes. The mesenteric glands were slightly enlarged and œdematous.

Adrenals. The left adrenal was healthy; organ was rather dark in color, but showed no change in substance. The right adrenal lay close under the diaphragm of the right side, and there was a continuous infiltration of tumor mass from the infiltrated diaphragm over the peritoneal surface of the adrenal and kidney. The right adrenal showed a small nodule, 1 x 1.5 cm., with tumorous substance within it.

Left Kidney. 200 grams; organ was firm and cedematous, 12 x 3.75 x 5 cm. Capsule was thin and peeled readily. Organ was indurated. The cortex was swollen. A slight amount of tissue was removed with the capsule, near the hilum. The pelvis and ureter were free.

Right Kidney. 230 grams, 12.5 x 3.7 x 5 x 4 cm. Organ showed a tumor mass beneath the capsule, 6 mm. in diameter. The kidney substance was infiltrated as far as the pyramids and about the pelvis. The tumor mass was light in color and, on the surface, displaced kidney tissue entirely. Ureter was free. The spermatic vein was thrombosed. The inferior vena cava opposite the renal vein showed a large and firm thrombus, firmly adherent, measuring about 4 cm. in length. Its lumen, however, was not entirely obliterated.

Bladder. Several veins about the bladder in front, and also the prostatic plexus, were thrombosed. The bladder mucosa was reddened and slightly œdematous, but otherwise healthy.

Prostate. Normal. Testes were clear.

Bones. Sternum: Opposite the tumor mass of the right thorax the sternum was infiltrated in its bony and cartilaginous tissues, as well as the intercostal muscle, by newgrowth. The bone was much softened, and, in parts, appeared carious. The plaque of infiltration of newgrowth against the sternum was 11 cm. in diameter,

from above downward, and lay mostly to the right side. Opposite the clavicles the tumor lay on the first rib and was adherent to it on the left side. The right side was free. The vertebræ did not appear infiltrated.

Microscopic Examination. Aorta. The aortic wall, including intima and media, was clear, save for the faintest fatty degeneration of some of the muscle cells. Immediately beyond the media, that is, in the adventitia, the aorta was nothing but tumor, with some blood-vessels within it. The tumor cells were mainly of the small round-cell character, with a few spindly-looking cells and nuclei mixed in it. It was remarkable that no tumor infiltration was to be found in the media of the aorta, although the tumor cells came directly up to this tissue. The tumor cells were the size and shape of lymphocytes, with relatively large and dark-staining nuclei, with but little protoplasm surrounding them. The cells were massed together, with little stroma between them, nor was there any capsule or membrane limiting the tumor mass. The tumor cells advanced at the periphery by infiltration.

Heart. The heart muscle, where such was present, appeared healthy, save that in places it had suffered from compression. The pericardial surface showed a layer of fibrous tissue on the outside, with an infiltration of tumor cells beneath it. The epicardial fat was infiltrated with tumor tissue. All through the heart muscle, and lying between the bundles of muscle cells, was tumor tissue of the character of a small round-cell sarcoma. The normal fibrous tissue of the heart was still to be made out. In one area tumor cells were to be found within a bloodvessel. The infiltration of tumor was frequently in large heavy strands.

A transverse section was taken of the ventricular septum on the right side just below the insertion of the tricuspid valve. The section extended across the entire septum through the regions occupied by the bundle of His, and extended half way through the thickness of the septum, which, at this part, varied up to 2 cm. in diameter. Macroscopically, the septum, at this point, showed only a few heart muscle fibers at the extreme ends (right and left) of the septum. In the sections made it was found that sarcomatous tissue had almost entirely displaced the heart muscle, and only here and there were some bundles of fibers, whose individual elements were permeated with newgrowth. In none of the sections could the bundles of His be distinguished, or any trace of them found.

The entire interventricular septum was obtained, special precautions being taken to preserve the septum fibrosum and the surrounding tissue. The septum was then divided into blocks suitable for section, and serial sections were made from before backward. In this way the entire thickness of the septum was obtained, and the entire area covered by the bundle of His was examined.

Although the course of the auriculo-ventricular bundle has been

fairly well defined, and the situation of the two limbs in the two ventricles of the normal heart is known, yet considerable difficulty is experienced in definitely locating the position of the muscle bundles in a specimen so completely disorganized by newgrowth as the one under observation.

As above stated, the greater portion of the interventricular septum is infiltrated with newgrowth to within a short distance of the apex. The infiltration of the new growth into the septum has thickened it and increased its bulk to a considerable extent. The infiltration is greatest at the upper portion of the septum, and occupies its tissue from its anterior to its posterior margins. The endocardial surface appears quite smooth, and the endocardium seems to be retained over it. On cutting into the septum, one cannot distinguish the presence of muscle tissue with the naked eye. The white and infiltrated appearance of the septum is the same from both ventricles.

The sections of the septum show the muscle tissue almost entirely replaced by tumor cells. These latter cells are of the small round variety, having in the most part a round, darkly-staining nucleus, with very little protoplasm surrounding it. The cells take no definite arrangement among themselves or at the stroma. The stroma is very sparse and appears to be that which normally exists in the heart muscle. The tumor advances at its borders by infiltrating the connective tissue between the muscle fibers and by their mass, obliterating the muscle cells of the part. The infiltration of the tumor beneath the endocardium appears more rapid than in the muscle tissue. The most advanced infiltration is found immediately beneath the endocardium and its connective tissue layer. The degree of infiltration of the musculature varies in different parts, but in general the greatest infiltration and obliteration of muscle tissue is found in the uppermost part of the septum.

The usually thin and tendinous septum fibrosum is half an inch in thickness, being occupied over its right surface by a thick tumor mass. This extends downward on the right side beneath the endocardium.

Along the anterior and lower margin of the septum fibrosum, where connective tissue strands pass in a V-shaped figure into both ventricles, there is considerable tumor infiltration, but there remains, however, a certain number of muscle fibers at the point of the fibrous division. These fibers prove to be the remains of the heart muscle and distinctly show transverse striations of their substance. Directly beneath the endocardium of the left ventricle tumor cells occupy almost the entire tissue, leaving only here and there occasional strands of connective and elastic tissue, while among these an occasional cell, looking like a muscle fiber, is encountered. These apparent muscle fibers are considerably distorted by the pressure of the tumor cells. Close examination does not reveal any cross striations. Their position is usually among what are connective tissue

strands beneath the endocardium, and occasionally elastic fibers are demonstrated in their neighborhood. Although serial sections were obtained of this area, these fibers cannot be followed as a bundle for any distance, as these elements exist only as scattered cells, having, histologically, no close association with other fibers like them.

In the sections made anterior to the septum fibrosum, no elements of this nature were apparent.

Again, in sections made transversely through the septum at various levels, definite muscle elements, occupying the position of the bundle of His, could not be made out more clearly than the fibers already described. Everywhere these fibers appeared atrophied, and had lost their usual plumpness. At times even the fresher of the surrounding tumor cells compress the individual fibers. No muscle elements having even a suspicion of the His' bundle are evident in the right ventricle.

Lung. The alveoli were still well marked out, but were filled with a clear exudate and red blood cells. There was no leukocytic infiltration.

Spleen. Fairly congested, and lymphoid tissue was rather diffuse. There was no evidence of tumor infiltration.

Adrenal. Section consisted almost entirely of tumor tissue, with strands of adrenal cortex scattered through it. The staining differentiated very well the tumor from the adrenal. The tumor cells varied in their appearance from large protoplasmic cells to small, almost lymphoid, tissue; the medulla of adrenal did not appear infiltrated.

Kidney. The greater portion of the section was infiltrated with tumor mass. In infiltrated areas nothing remained of the tubules or of the original kidney substance, save the bloodvessels and glomeruli. The tumor mass was made up of irregular small cells, distributed in strands and small masses. There was a considerable stroma between the individual cells and masses of cells. In many cases the tumor cells were definitely spindle-shaped.

Liver. Very little was left of liver tissue in the section. Its entire area was occupied by tumor of a sarcomatous nature. Some of the original fibrous tissue bands were still present. Within the remaining liver tissue stagnated bile pigment was found. There was considerable stroma to be found in the tumor tissue.

To sum up, the anatomical findings which interest us most are the extensive sarcomatous infiltrations of the heart, its pericardium, and its large veins. In substance the heart is occupied by sarcomatous tissue in two-thirds of its mass. The sarcomatous invasion has replaced the heart muscle to a great extent, not only in its outer walls, but also in the auricular and ventricular septa. Histological examination of the septum demonstrates a disorganization of the bundle of His. Although we cannot definitely say that the bundle of His has been completely obliterated, yet truly recognizable

Purkinje fibers were not found. If we allow, however, that the distorted muscle-like elements appearing beneath and among the connective tissue fibers of the septal endocardium are elements of the bundle of His, we still find that these elements have been greatly reduced in number, and those that are present have been compressed and distorted by the sarcomatous infiltration. It is not at all clear to us that all these subendothelial fibers are of the Purkinje type. In fact, we must admit that some are, most probably, elements belonging to the longitudinally disposed heart muscle fibers, which appear superficial to the situation of His's bundle.

In view of the extensive disorganization of the bundle of His, it is difficult to correlate the clinical findings with the generally accepted views concerning this bundle. If the bundle of His is alone responsible for the maintenance of the proper rhythmic contraction of the ventricle, then we must assume that an extremely small number of these fibers can carry on that function for the proper maintenance of life. In the case described, the few Purkinje fibers which remained (if such they were), were very much altered by sarcomatous invasion and pressure. The function of these few cells must have been considerably diminished, and could only have supplied impulses to a small portion of the ventricle.

It is more than likely that the heart is dependent not alone upon the bundle of His for the transmission of impulses and the proper correlation between the auricle and ventricle, but that other factors, such as the cardiac muscle, central nerve fibers, and cardiac ganglia with their nerve plexuses, each and all may assume a portion of the work of maintaining a proper control and relationship of auricle and ventricle.

THE ASSOCIATION OF "RHEUMATIC FEVER" AND THE ERYTHEMA GROUP OF SKIN DISEASES.

WITH A REPORT OF FOUR CASES.

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UNDER the erythemas, in addition to simple erythema, erythema nodosum, erythema multiforme and exudativum, Osler¹ includes urticaria, purpura, and angioneurotic cedema. This classification is used by recent writers, though it is, perhaps, open to the criticism that the term erythema is not descriptive of, at least, two diseases included in this group—urticaria and angioneurotic cedema. In the absence of a more comprehensive title, the above classification will be used in this report.

¹ AMER. JOUR. MED. SCI., 1904, cxxvii, 1; Brit. Jour. Dermat., 1900, xii.

Most writers consider that there is some relationship between rheumatic fever and some of the members of the erythema group of skin diseases—simple erythema, erythema exudativum, erythema nodosum, and purpura—and that these diseases may be rheumatic complications. Recently, doubt has been expressed in reference to this association, and it is the object of this paper to report four cases which seem to have some bearing on the question.

It has long been known that the members of this group of skin diseases are in some way related. They are frequently seen in association with the same diseases, often at the same time, and frequently replace one another. Osler has called special attention to the similarity of the various members of this group and to their visceral manifestations. To quote this writer: "The essential process is a vascular change with exudate, blood, serum, alone or combined. While five or six of the affections just named [Osler refers to simple erythema, erythema exudativum, herpes iris, erythema nodosum, certain of the purpuras, and angioneurotic oedema] are described usually as separate diseases, they belong to one family, and are characterized by the similarity of the conditions under which they occur, the frequency with which the lesions are substituted the one for the other at different times, the tendency to recurrence, often through a long period of years, and, lastly the identity of their visceral manifestations." In discussing the etiology of his cases Osler suggests that the rheumatic poison is probably responsible for many.

Cheadle² includes erythema exudativum and purpura rheumatica in the rheumatic series, and Poynton³ mentions the fact that purpura and erythema exudativum may be associated with rheumatic fever. Church⁴ found erythema nodosum as a complication in 10, and purpura in 16, out of 1431 cases of rheumatic fever. The frequency with which erythema nodosum bears the stamp of a primary disease has led Symes,⁵ among others, to doubt its association with rheumatic fever. It is believed by these writers that the arthritic symptoms which often accompany this primary form of erythema nodosum have led in many cases to the unwarranted diagnosis of rheumatic fever.

On similar grounds there is diversity of opinion in reference to purpura. Mackenzie⁶ found 61 out of 200 cases of purpura to be associated with rheumatism, while Pratt⁷ believes that this association is uncommon. The latter suggests that most cases in which purpura is described as a rheumatic complication merely

² System of Medicine, Allbutt and Rolleston, ii, Part 1, p. 645.

³ Modern Medicine, Osler and McCrae, ii, p. 676.

⁴ System of Medicine, Allbutt and Rolleston, ii, Part 1, 594.

⁵ Lancet, January 26, 1907.

⁶ System of Medicine, Allbutt and Rolleston, v, p. 845.

⁷ Modern Medicine, Osler and McCrae, v, p. 681.

represent forms of arthritic purpura and are different in nature and origin from true rheumatic disease.

It seems that these milder forms of symptomatic arthritis which occur in connection with erythema nodosum and purpura are responsible for this confusion. In the present state of our knowledge the basis for the diagnosis of rheumatic fever is entirely clinical, and it is merely on clinical grounds that it is differentiated from other diseases of which arthritis is one of the symptoms. It may be true, in some instances, that the occurrence of arthritic symptoms with these skin diseases has led to the hasty diagnosis of rheumatic fever, and that in these cases the skin lesion, an essential part of the disease, was considered a complication.

Whether the distinction of rheumatic fever from the forms of purpura and erythema nodosum presenting mild arthritic manifestations is justifiable, or whether they are closely related, is entirely a question of etiology. The answer can only be given when we know the agencies on which these diseases depend; and until established this confusion must, to some extent, continue. From a purely clinical standpoint, however, the distinction seems fairly clear, for these forms of symptomatic arthritis are usually mild and do not give rise to the clinical signs, the course, or the complications of true rheumatic disease. Yet it must be admitted that some cases of proved rheumatic disease present slight arthritic manifestations, but these cases occur most frequently in children, and the complications disclose the real nature of the affection.

Angioneurotic oedema is rarely mentioned as a complication of rheumatic fever, though its association with the other members of the erythema group is unquestionable. When it occurs as a primary affection the clinical picture is not that of an infectious disease, as is frequently the case with the primary forms of purpura, erythema nodosum, and exudative erythema. Acute general symptoms are usually lacking, and the attacks which occur over long periods of time are separated often by intervals of months or years.

Urticaria not infrequently accompanies rheumatic fever, but its relationship to this disease is not clear. Urticaria may be associated with so many conditions that its occurrence with rheumatic fever may be purely coincidental. The frequent occurrence of urticaria with the other members of the erythema group whose association with rheumatic fever is better established would seem to indicate more than mere coincidence.

The members of the group of skin diseases under discussion occur under many different conditions, and it is both unnecessary and beyond the scope of this paper to attempt their description.

In the following cases members of the erythema group of skin diseases occurred in rheumatic subjects or in association with rheumatic fever.

CASE I.—*Rheumatic fever; purpura; urticaria; angioneurotic œdema; erythema simplex. Recovery.*

The patient, a man, aged thirty-five years, a teamster by occupation, was admitted to the hospital May 7, 1906. Both parents are living and well. There is no history of rheumatic fever in the family. The patient had measles and diphtheria when a young child and chorea at the age of ten years. He has been subject to tonsillitis for many years.

The first attack of acute articular rheumatism occurred seven years ago. The patient was ill for six weeks and recovered completely. He had a second and third attack of this disease four and two years ago, respectively, and during the latter attack "large purple blotches" appeared on the legs and abdomen. Three years ago he had bilateral suppurative otitis media, and for five months there was a discharge from both ears. The discharge has reappeared twice since the primary attack. Five years ago the patient had gonorrhœa, which lasted six months. He has been a heavy drinker, smokes moderately (?), and works very hard when sober. For four weeks preceding the onset of the illness the patient had been drinking heavily, but was apparently in good health. Four days before admission to the hospital he became ill. At this time the left wrist was swollen and very painful. The next day a rash appeared on both lower extremities and the patient became delirious.

The following are the notes of the examination on admission: The patient is not aware that he is in the hospital, and does not respond to questions in an intelligent manner. He is well nourished and muscular, the face is flushed, both pupils react to light and accommodation, and there is a slight purulent discharge from both ears. The tongue is heavily coated in the centre, but the edges are clean. Both tonsils are large and almost meet in the median line, but show no signs of acute inflammation. There are a few medium moist rales at the extreme base of each lung, and with this exception the examination of the lungs is negative. The point of maximum cardiac impulse is in the sixth interspace in the mid-clavicular line. The right border of relative cardiac dulness cannot be outlined. On the left side the relative cardiac dulness extends 6 cm. from the left sternal border in the third interspace. At the apex the first sound seems normal, the second indistinct. At the base both sounds are indistinct, though the aortic second is louder than the pulmonic second. The radial pulse is of moderate volume, is well sustained and the arterial wall is moderately thickened. The systolic blood pressure is 120 mm. Hg. (Riva Rocci instrument, wide cuff). The abdomen is not distended and the respiratory movements are well seen. Neither the liver nor the spleen can be felt and there are no palpable masses. The areas of splenic and liver dulness are normal. There is a hemor-

rhagic eruption over the arms, legs, and trunk. The eruption consists of two elements, large purpuric spots 1 to 3 cm. in diameter and fine petechiæ. Both forms are in distinct crops, some have almost faded and are yellowish, others have a purplish color, and the remainder are scarlet. On pressure a few of the petechiæ become colorless, but the greater part of the rash is unchanged. There is an erythematous area over the posterior portion of the left leg, and extends from just above the ankle-joint to the middle of the calf. This area shows no induration and no increase of local temperature. The left wrist is swollen and the slightest motion is very painful. The overlying skin is tense, hot, and pits on pressure. There is slight swelling over the dorsum of the hand. The patient is actively delirious; he thinks that he is driving horses and does not recognize the members of his family. The hands show a coarse tremor. The tendon reflexes are slightly exaggerated in both extremities. Kernig's sign is not present, there is no ankle clonus, and the planter response is normal.

On May 8, the sixth day of the illness, the left knee was greatly swollen, tender, and hot. The patient was delirious and very restless. The urine had a specific gravity of 1028, was clear, amber colored, and contained a slight trace of albumin. The microscopic examination was negative. The blood contained 23,000 white cells per c.mm., and a differential count gave the following results: Polymorphonuclear cells, 83 per cent.; lymphocytes, 11 per cent.; large mononuclear cells, 3 per cent.; eosinophiles, 0.2 per cent.; and cells with basophilic granules, 0.6 per cent. Four hundred cells were counted.

May 9. The right ankle-joint is swollen and inflamed. The hemorrhagic rash is less distinct and there are no new elements. The erythematous area on the left leg has almost disappeared. The patient is weaker, and takes little nourishment.

May 10. Over the right side of the head there is a large subcutaneous swelling which extends horizontally from the posterior median line to the auricle and vertically from the sagittal suture to the tip of the mastoid process. The swelling is circumscribed, covers an area about 9 cm. in diameter, and is greatest over the mastoid process. The local temperature is not increased, the skin is not reddened, and pressure over the mastoid process elicits no sign of pain. The swelling pits deeply on pressure. The patient is seen by Dr. W. S. Shattuck, who thinks that there is no mastoid involvement. The erythematous area has disappeared from the left leg, but there is a fine desquamation of the skin over this area. The hemorrhagic rash is much fainter. The patient has profuse sweats.

May 11. The swelling described in the last note has almost disappeared. The urine contains a slight trace of albumin. There is no change in the patient's general condition.

May 13. There have been several crops of urticarial wheals over the abdomen, back, and lower extremities, and there is well-marked "dermatographia." The left ankle-joint is inflamed; the swelling of the other joints has greatly diminished and motion is much less painful. The patient is irrational at times, but he has lucid moments, at which times he is able to recognize his surroundings. He still perspires freely. The swelling which was in the mastoid region has disappeared and no trace of it remains.

May 15. The patient is much better today; his mind is perfectly clear and he is able to recognize the members of his family. The urticaria has not recurred and the arthritis is rapidly subsiding. The joints which were first involved are entirely well.

May 16. The improvement continues. The left knee- and ankle-joints are still slightly inflamed, but the signs of inflammation have diminished. The site of the hemorrhagic rash is marked only by a few yellowish spots. The examination of the urine is negative. From this time the improvement was rapid. On May 21 the arthritis had entirely subsided, and two days later the patient was allowed to get out of bed. A complete physical examination at this time showed nothing of importance.

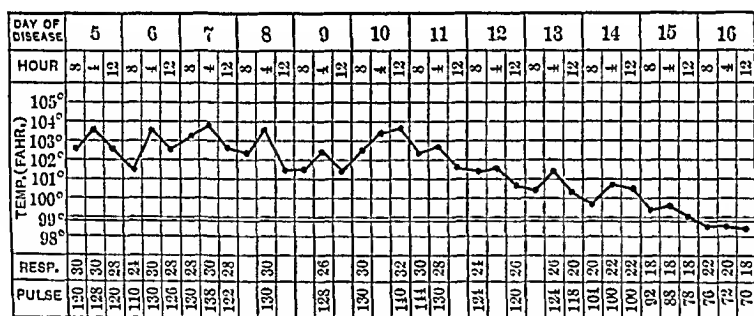


FIG. 1.—Temperature chart of Case I.

Sodium salicylate and sodium bicarbonate were given in 20-grain doses every three hours during the febrile period (Fig. 1). At the time of the angioneurotic oedema, 20 grains of calcium lactate was given every four hours. Clinically, this case was clearly one of rheumatic fever. The history of chorea and of previous attacks of rheumatic fever, as well as the nature of the arthritis in the present attack and its improvement under the administration of sodium salicylate, give sufficient evidence.

The area of angioneurotic oedema over the mastoid process in the presence of chronic otitis media suggested, at first, that the swelling was due to mastoiditis. The absence of signs of inflammation, the findings on examination of the ear, and the rapid subsidence of the swelling were sufficient to exclude this diagnosis.

CASE II.—*Rheumatic fever; erythema nodosum; purpura; urticaria; erythema exudativum; intestinal hemorrhage; pericarditis. Death on the twenty-first day of the disease.*

The patient, a man, aged thirty-five years, was admitted to hospital on December 28, 1906, and gave the following history: No member of the family has suffered from rheumatic fever or skin eruptions. The patient contracted syphilis six years ago, and was treated for three years. Four years ago he was ill four weeks with acute articular rheumatism, and recovered completely from this disease. During the illness there were a few reddish nodules on both legs, which the patient thinks were similar to those now present. Three years ago he was ill with typhoid fever for six weeks. He has been a heavy drinker for twelve years and smokes ten to twenty cigars a day. Previous to the present illness the patient was in good health. The onset of the disease was sudden four days before admission to hospital. The initial symptoms were headache, general pains in the muscles, fever, and cough. The next day the right ankle became swollen and painful. On the third day of the illness there was a small intestinal hemorrhage, and a rash appeared on both legs. On the basis of a typhoid agglutination reaction the disease was diagnosticated typhoid fever and the patient sent to the hospital.

Note on the day of admission to the hospital, the fifth day of the disease. The patient complains of weakness and cough. He is a large, rather fleshy man. The face is flushed, he is semi-stuporous, but can be easily roused, and answers questions in a rational manner. There is profuse sweating over the whole body. Examination of the nose, ears, and pharynx reveals nothing of importance. The posterior cervical, submaxillary, and inguinal lymphatic glands are palpable, but are not greatly enlarged. Over the base of each lung are a few sonorous and sibilant rales; with this exception the examination of the lungs is negative. The point of maximum cardiac impulse is in the fifth interspace 2 cm. within the midclavicular line. The right border of cardiac dullness corresponds to the right sternal border. In the third left interspace the relative cardiac dullness extends 5.5 cm. from the left sternal border. The heart action is rapid and sounds are clear at both apex and base. At the base of the heart the second aortic sound is accentuated. The radial pulse is small, well sustained, and the arterial wall is moderately thickened. The systolic blood pressure is 118 mm. Hg. (Riva Rocci instrument). The abdomen is symmetrical, soft, and there is no evidence of pain on palpation. On deep inspiration the edge of the liver can be felt below the costal margin; the upper border of liver dullness begins at the level of the fourth right interspace. The area of splenic dullness is increased, but the edge of the spleen cannot be felt on abdominal examination. Over each lower extremity there

are 15 to 20 indurated purplish nodules, which vary from 0.5 to 1 cm. in diameter. They involve the entire depth of the skin and become colorless on pressure. These nodules are distributed over both lower extremities from the ankle to the hip, but they are thickest in the region of the knee- and ankle-joints, and there are two on the lower part of the abdomen. There are several large purpuric spots on the back and right leg. The right ankle-joint is swollen and the slightest motion is very painful. The skin is tense, shiny, and hot. There is slight subcutaneous œdema of the right foot.

On admission the temperature was 103° F., the pulse 120, and the respirations 36. In dilutions of 1 to 20 the patient's blood serum agglutinated typhoid bacilli in one and one-half hours, but in dilutions of 1 to 50 agglutination was absent at the end of three hours. The white blood cells were 26,000 per c.mm. and were present in the following proportion: Polymorphonuclear cells, 82 per cent.; lymphocytes, 12 per cent.; large mononuclear cells,

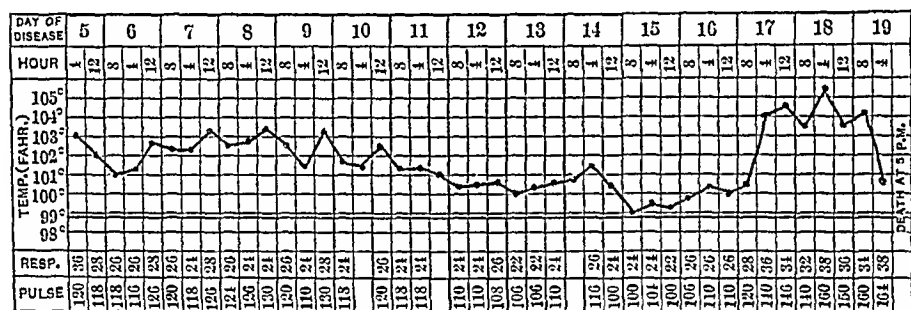


FIG. 2.—Temperature chart of Case II.

3 per cent.; eosinophiles, 0.2 per cent.; and cells with basophilic granules, 0.1 per cent. Four hundred cells were counted. The urine was clear, high colored, and contained a faint trace of albumin. The specific gravity was 1022 and the microscopic examination was negative; 8 c.c. of blood was taken from the median vein and glucose agar, broth, and blood serum inoculated. The media was incubated at 37° C., but no bacterial growth occurred.

For three days there was no important change in the patient's condition. The temperature was almost constantly in the vicinity of 103° (Fig. 2), but there were slight morning remissions. During this time the rash began to fade, the edges of the nodules became yellowish, and the induration less marked. On the fourth day in the hospital the left elbow was swollen and showed all of the signs of acute inflammation. On the following day the left ankle showed similar signs, and two days later the right knee became involved. During this period the temperature ranged from 101° to 103° F. and the rash faded considerably. A few dry rales were

present in the posterior portion of each lung, but there was little cough. During this time the patient became much weaker.

For three days the patient showed signs of improvement; he was brighter, took more nourishment, and the temperature ran a lower course. The inflammation of the right ankle-joint almost disappeared and the swelling was less in the left ankle- and elbow-joints. The right knee was still greatly inflamed.

On January 7, the eleventh day in the hospital, a rash was noted on the front of the chest and on the buttocks. This rash consisted of many papules 2 to 5 mm. in diameter, pinkish in color, and raised above the surrounding skin. The papules were very thick on the chest and coalesced in places to form several large plaques 2 to 4 cm. in diameter.

On January 9 the following note was made: The papules have increased in size, but no new ones have appeared. The plaques are very distinct and the edges are gyrate. These areas show three grades of coloring; the centre is grayish, outside of this is a yellowish zone, and the external border is reddish purple. The patient has been actively delirious for twenty-four hours, he takes very little nourishment, and is quite weak. There are a few urticarial wheals on the back and lower extremities. The right border of cardiac dulness extends 3 cm. to the right of the right sternal border in the third interspace. In the third left interspace the relative cardiac dulness extends 6.5 cm. from the left sternal border. The apex impulse cannot be seen. There is a continuous thrill palpable over the precordial area, and corresponding to this thrill a to-and-fro friction rub can be heard, which is loudest over the base of the heart. The sound is rough, it seems close to the ear, is intensified by pressure, and obscures the heart sounds. The right ankle-joint appears normal, the left ankle and elbow are but slightly swollen, and the right knee shows signs of improvement, but is still inflamed. From this time the patient gradually became weaker, and death ensued on January 11, the nineteenth day of the illness. At the time of death the skin lesions had almost faded and the inflamed joints were in practically the same condition as at the time of the preceding note.

A postmortem examination was made on January 12 by Dr. Joseph. The examination of the lungs showed only congestion of the larger bronchi. The pericardial sac contained about 5 c.c. of a straw-colored fluid which contained a few flocculi of fibrin. The visceral and parietal surfaces of the pericardium were covered by a fibrinous exudate, and on its removal the surface of the membrane showed intense congestion. The myocardium showed fatty and parenchymatous degeneration. The mucous membrane of the small intestine was congested throughout the entire length, but there were no ulcers or changes in the lymphoid tissue. The origin of the hemorrhage could not be determined, and the large

intestine seemed normal. Permission was only obtained for a partial examination, and for this reason the remainder of the organs were not disturbed. Histological examination of the organs removed confirmed the anatomical diagnosis and revealed nothing of further importance.

The previous history of this patient, the nature of the arthritis, and its improvement under administration of salicylates seem to indicate the rheumatic origin of the disease. Of especial interest was the original diagnosis of typhoid fever, which was based on the agglutination reaction. The agglutination was present only in low dilution, and was presumably due to the previous attack of typhoid fever.

CASE III.—*Follicular tonsillitis; erythema multiforme; urticaria; colic. Recovery.*

The patient, a female, aged nineteen years, was admitted to the hospital on October 19 for chancroids. There was no family history of rheumatic fever or skin eruptions. The patient has had an attack of acute tonsillitis almost every winter since childhood. Two years ago, following an attack of tonsillitis, both knees and ankles were swollen and a skin rash was present. From the patient's description the rash was probably purpuric. She was in bed for five weeks, and the disease was followed by complete recovery. Her general health has always been good.

On November 3 she complained of sore throat, headache, and pains in the back and limbs. The tonsils were red and swollen and the crypts filled with a fibrinous exudate. The examination of the heart, lungs, and abdominal organs revealed nothing of importance. The temperature was 102.5° F., the pulse 118, and the respirations 24. The following day the morning temperature was 101° and the evening temperature 102°. A culture from the tonsils, made on November 3, showed colonies of an organism whose morphology and staining reactions corresponded to the streptococcus. After the usual treatment the temperature fell and the general symptoms disappeared. On November 6 the temperature was lower, but was still above normal; the morning temperature was 99° F., the evening temperature 101°. On this day there was a scattered erythematous rash on the abdomen, back, chest, and neck. The elements were discrete pinkish papules, 2 to 4 mm. in diameter, which were slightly indurated. The rash was symmetrical in distribution, became colorless on pressure, and on each side of the chest one of the papules was capped by a vesicle. The urine was negative. A blood count showed 15,000 white cells in the following percentages: Polymorphonuclear cells, 78 per cent.; lymphocytes, 16 per cent.; large mononuclears, 3 per cent.; eosinophiles, 2 per cent.; and cells with basophilic granules, 0.8 per cent. Four hundred cells were counted.

On November 7 the temperature was still slightly elevated, but

the patient felt comfortable. There were a few urticarial wheals on the back and the erythematous rash was unchanged. The tonsils were no longer congested, but were still slightly swollen. The following day the throat appeared normal, the patient complained of no discomfort, and there was no fever. There was a new crop of papules on the abdomen, chest, and back similar to those first described. About 11 P.M. the patient was seized with acute abdominal pain. The pain was general, cramp-like, came in paroxysms, and was most intense in the epigastrium. The bowel movements had been normal, and there was no vomiting during this attack. The pain was so severe that morphine was required, which rendered the patient more comfortable and she was able to sleep at intervals. Early the next morning the pain resumed its original severity and was accompanied by several vomiting spells. The abdomen was not distended, was soft, without muscle spasm or palpable masses. The morning temperature was 99° F. Toward noon the acute pain subsided, but a slight sensation of soreness remained. For the first time the patient complained of a burning sensation from the rash and the redness and induration of the papules were more noticeable. The evening temperature was 101°, the pulse 100, and the respirations 20.

On November 10 the temperature was normal and many of the papules were covered with vesicles containing a clear fluid. The rash showed signs of fading on the next day, and some of the vesicles were less distended. The temperature was normal and the patient felt comfortable.

On November 12 a systolic murmur was audible over the entire precordium, but of greatest intensity at the pulmonic area. There was no increase of the relative cardiac dulness and the murmur was not transmitted to the axilla or back. The temperature was normal; the radial pulse was regular, 78 to the minute, and of good volume and tension. The arterial wall was not thickened.

By November 20 all signs of the rash had disappeared and the patient seemed entirely well. At this time the cardiac murmur was faint and was present only at the pulmonic area.

It may be urged that the rheumatic nature of this case is questionable, since arthritis was not present during the illness. The history of arthritis, which corresponded to rheumatic fever, a purpuric rash at this time, and tonsillitis at the onset of the recorded illness are points which seem at least suggestive. The attack of abdominal pain was probably of the same origin as that seen in Henoch's purpura and in connection with angioneurotic edema. The heart murmur was probably of functional origin.

CASE IV.—*Tonsillitis; urticaria; erythema nodosum; period of improvement with the occurrence of angioneurotic edema; sudden onset of pericarditis. Death.*

The patient, a female, aged twenty-two years, was admitted

to the hospital suffering from gonorrhoeal vaginitis, but at the time of the present illness there was no evidence of this disease. There had been no perceptible discharge for more than two weeks, and four vaginal and urethral smears made on alternate days were negative. There was no family history of rheumatic fever. The patient had measles and mumps when a young child. She has had three severe attacks of tonsillitis, and following this disease, two years ago, the left ankle, right knee, and both elbows became swollen. The joints were involved in succession; they were greatly swollen and motion was very painful. The recovery from this attack was complete in two months. Two months before the present illness the patient was treated in the hospital for rheumatic fever. Both wrists, the right knee, and the left ankle were affected. The acute arthritis lasted only two weeks, and the patient was discharged on the twenty-first day of the disease. There was no skin eruption during this attack. The onset of the present illness was sudden. The patient complained of headache, general pains in the back and limbs, and sore throat. The tonsils were red and greatly swollen, but there was no exudate. The general symptoms were severe. The temperature was 103° F., the pulse 130, and the respirations 28. Examination of the thoracic and abdominal organs was negative. On the second day the temperature fell to 100.5° and the patient was more comfortable. There were a few urticarial wheals on the abdomen. The congestion of the tonsils was less, but swallowing was quite painful. On the third day of the disease there were 10 to 15 reddish nodules on each leg below the knee. They were hard, about 1 cm. in diameter, and the color disappeared on pressure. The temperature in the morning was 98° F., in the evening, 99°. At this time the signs of acute inflammation of the tonsils had almost disappeared. For a time there were no further developments; the patient slowly improved, and in seven days from the onset of the illness was out of bed, weak, but free from other symptoms. For the first two days after their appearance the papules increased in size and seemed to involve the entire thickness of the skin. They later became purplish, and then began to fade. Beyond slight anemia, there were no abnormal physical signs at this time. The red blood cells were 4,100,000, the hemoglobin was 50 per cent., and the white cells were 8000.

On November 12, fourteen days from the onset of the tonsillitis, there was a large subcutaneous swelling over the left eye. The swelling was circumscribed, it pitted on pressure, was about 4 cm. in diameter, and was raised about 2 cm. above the surface of the surrounding skin. The temperature was 99°, the pulse 122, and the respirations 20. The urine was pale, the specific gravity was 1022, and no abnormal constituents were found. The swelling over the eye began to decrease in size about six hours after its

appearance, and in twenty-four hours had entirely disappeared. There were no other symptoms at this time.

On December 1 the patient became very ill. The temperature, which had been running a normal course, rose to 104°; the pulse was 140, and the respirations were labored and 32 to the minute. The patient had been slowly improving and was out of bed at this time. The following note was made: The respirations are labored, the facial expression anxious, and the skin is slightly cyanotic. The examination of the thoracic and abdominal organs, with the exception of the heart, is negative. The point of maximum cardiac impulse is in the fifth interspace, 3 cm. within the mid-clavicular line. There is a distinct to-and-fro thrill over the entire precordium, and corresponding to this thrill a friction rub can be heard. The rub is loud, it masks the heart sounds, is increased by pressure, and is of greatest intensity over the base of the heart. The pulse is small, of low tension, and is irregular in both force and rhythm. Percussion over the heart is extremely painful, and for this reason no attempt is made to outline the cardiac dullness.

The patient did not improve, but lost consciousness and gradually became weaker. Death ensued thirty-six hours after the onset of the pericarditis. The request for a postmortem examination was refused.

This patient had two attacks of acute articular rheumatism. The latter attack occurred under observation, and though it was mild, it seemed a clear case of rheumatic fever. Arthritis was not a part of the recorded illness, but the onset with tonsillitis, and pericarditis as a complication, taken in connection with the previous history, suggest the probability of its rheumatic nature. Since the patient acquired gonorrhoea between the last attack of rheumatic fever and the fatal illness, the possibility of a gonorrhoeal septicemia has to be borne in mind. The evidence, however, is in favor of the rheumatic nature of this case, for there were no signs of pelvic inflammation and the patient had apparently recovered from the vaginitis.

It may be urged that at least two of the cases—the fatal Cases II and IV—should be placed in the category of septic infections, since rheumatic fever in adults is not frequently a fatal disease. It is well known that forms of arthritis occur with certain infectious diseases which may closely resemble the arthritis of rheumatic fever, and that some of the members of the erythema group of skin diseases may occur under similar conditions. In spite of this similarity the fatal outcome in the two cases referred to was due to pericarditis, which is one of the recognized clinical complications of rheumatic fever. Moreover, in the absence of a positive diagnostic test we are forced to adhere to the accepted clinical conception of rheumatic

fever, and the diagnosis can be based only on the presence of the clinical features of the disease.

In Cases I and II the evidence in favor of the rheumatic nature of the disease is rather strong. The previous history, as well as the clinical characteristics of the observed illness, all point in this direction. In Cases III and IV the evidence is based almost entirely on the history. In Case III an attack of arthritis, which corresponded closely to rheumatic fever and which was accompanied by a purpuric rash, is of importance. In the fourth case a definite attack of rheumatic fever occurred under observation a short time before the recorded illness. The onset with tonsillitis in both of these cases is also suggestive.

To repeat, in two of the four cases—I and II—members of the erythema group were associated with arthritis clinically indistinguishable from the arthritis of rheumatic fever; in the remaining cases arthritis was not a part of the disease, but the previous history and certain features of the recorded illness are strongly suggestive of their rheumatic origin.

The many and varied conditions under which the members of this group of skin diseases occur, either singly or in combination, seem to indicate that there is not a uniform causative agent, but that different agencies may be responsible. It is not unreasonable to suppose that among these is the causative agent of rheumatic fever.

These cases were from the service of Dr. A. C. Brush, Dr. J. R. Stivers, and Dr. C. S. Cochrane, at the King's County Hospital, and I desire to acknowledge their kindness in permitting me to make this report.

ACQUIRED HEMOLYTIC ICTERO-ANEMIA.

WIDAL'S SYNDROME.

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ACQUIRED hemolytic ictero-anemia, a disease, or syndrome, a knowledge of which is of very recent date, is characterized by the development during adult life of icterus, accompanied by anemia; in other words, an ictero-anemia. The peculiar features attached to this condition, and raising it to the dignity of a special pathological entity, are enlargement of the spleen, urobilinuria, and characteristic changes in the blood. The differentiation of this particular type of icterus is due principally to Widal, whose first article on the subject appeared in November, 1907.¹

¹ Bull. et mém. Soc. méd. des hôp. de Paris, 1907, 3d ser., No. 31, p. 1127.

As early as 1900 Minkowski² described a condition of congenital icterus characterized by chronic jaundice often hereditary, urobilinuria, splenomegaly, and renal siderosis. Several cases of this form of chronic congenital icterus have been since reported, and inasmuch as Chauffard³ first showed that the resistance of the red corpuscles is diminished in this type of icterus, it has been called the Minkowski-Chauffard syndrome. In both the congenital and acquired forms of ictero-anemia the changes which take place in the blood have attracted much attention and have been the subject of much investigation, all of which has tended to show that both of the prime objective symptoms, the icterus and the anemia, are dependent upon hemolysis, and furthermore that the hemolysis is intimately connected with, if not absolutely dependent upon, an abnormal fragility of the red blood corpuscles.

In the ordinary forms of retention or biliary icterus, the resistance of the red blood corpuscles is increased. This was first shown in 1902 by Vaquez and Ribierre,⁴ who based their conclusions upon the notation of the beginning and ending of hemolysis in a series of differently graduated saline solutions, each containing a drop of the patient's blood. A slight modification of this technique, which will be later described, has been employed in determining the existence of an abnormal fragility of the red blood corpuscles in cases of congenital and of acquired hemolytic ictero-anemia. The present article will deal exclusively with the acquired form.

Eight cases of this syndrome with their hematological findings, including one case in which an autopsy was performed, have been reported in the literature. I have observed one case during the last summer (August, 1909) in Professor von Noorden's clinic in Vienna, under Docent von Jagic. The following is a list of the authors who have reported cases:

F. Vidal, in November, 1907, reported the first two observations of this disease, both of which cases he followed for two years, their subsequent histories being made the basis for a second report, which appeared in July, 1909.⁵ W. Oettinger,⁶ in October, 1908, reported the history of a case in which death occurred from an intercurrent pneumonia. The report includes a study of the autopsy findings. E. Saquepée,⁷ in October, 1908, reported two cases, in both of which malarial parasites were found in the blood. P. Le Gendre,⁸ in January, 1909, reported one case. Ritter von Stejsal,⁹ in May, 1909, reported two cases observed in von Neusser's clinic in Vienna.

² Verhändl. des 18 Kongr. f. innere Med., Wiesbaden, 1900.

³ Semaine médicale, January 16, 1907.

⁴ Soc. de biol., July 26, 1902, p. 1074.

⁵ Bull. et mém. de la Soc. méd. des hôp. de Paris, 1909, No. 25, 3rd ser., p. 73.

⁶ Ibid., 1908, No. 31, 3rd ser., p. 391.

⁷ Ibid., p. 361.

⁸ Ibid., 1909, No. 3, p. 112.

⁹ Wien. klin. Wochenschr., July 22, 1909, No. 19, p. 661.

The case seen by me has not been reported up to the present time. The following description of the symptomatology and pathology of this syndrome is based upon these cases.

SEMIOTICOLOGY. Acquired hemolytic icterus is more common in females than in males. Six of the cases were in females, and three in males. The family history was practically negative in all of the cases. A history of tuberculosis in the family was noted in one case, cancer of the stomach in two, and chlorosis in one. In none of the cases was heredity a factor. The ages of the patients, at the time of development of the disease, ranged from sixteen to sixty-seven years, and were as follows: Sixteen, nineteen, twenty-one, twenty-two, twenty-nine, thirty-four, forty-one, forty-two, and sixty-seven years.

The previous histories of the cases are devoid of any common factor to which an etiological significance can be assigned. The following brief protocols furnish all the facts in each case, which are important in this respect.

CASE I.—Measles, variola, ischiorectal abscess followed by rectitis for nearly a year prior to the development of icterus.

CASE II.—Abortion at the second month, followed by hemorrhages without sepsis, lasting nine weeks.

CASE III.—Acute rheumatism with cardiopathy, hepatic colic.

CASE IV.—Intermittent fever.

CASE V.—Quartan fever, bilious attacks, with hematuria. Intermittent fever.

CASE VI.—No antecedent illness.

CASE VII.—No illness antedating the commencement of the disease.

CASE VIII.—Pleurisy with effusion, variola, and diphtheria in childhood. Personal case; no sickness prior to attack; healthy, but not vigorous.

The disease has begun in all reported cases rather insidiously. The first symptoms noted were indefinite, such as malaise, weakness, palpitation, vertigo, and dyspnoea on exertion. Headache or peculiar subjective sensations in the head may be present. These symptoms may arise independently, or may occur associated with more definite pathological states, such as an abortion, rheumatic cardiopathy, malarial fever, etc.

The patient soon notices a yellowish discoloration of the skin, or this may be discovered by friends or by the physician. This icterus or subicterus involves the skin of the trunk and extremities, frequently also the conjunctivæ and mucous membranes, and is of varying intensity. The jaundice is found upon further examination, to be peculiar in that the typical concomitant symptoms of an ordinary retention icterus are absent. There is no itching or pigmentation of the skin, no lesions of scratching, no bradycardia, and no emaciation. Furthermore, the stools are normal in color, and the urine, though dark in color, contains urobilin but no bile pigment.

Developing simultaneously with the icterus is a state of anemia manifested by weakness, fatigue on exertion, or even extreme prostration, pallor of the skin and mucous membranes, low blood pressure, and hemic murmurs. The earliest objective syndrome is therefore an icterus combined with anemia. The anemia has been found to be associated with and dependent upon profound changes in the blood. These will be later described.

Besides the icterus and anemia, a third symptom is present which is quite characteristic—enlargement of the spleen. Splenomegaly has been noted in all the reported cases, and was present in the case observed by me. The organ is also tender upon pressure, and in some of the cases there are spontaneous pains felt in the left hypochondrium. The spleen may be palpable below the ribs, and occasionally a perisplenic fremitus may be felt upon manipulating the organ. The upper border may be found upon percussion in the seventh intercostal space in the mammary line. In one case its vertical diameter was 17 cm., its transverse 20 cm. As will be later mentioned, the spleen undergoes variations in size during the course of the disease, and these variations coincide with the exacerbations and improvements which characterize the affection, and serve to differentiate it from certain chronic anemias accompanied by stable tumor of the spleen. The heart examination is usually negative, except for anemic murmurs, which are sometimes audible. The pulse is usually somewhat faster and weaker than normal. The liver is usually somewhat enlarged, and in one case was palpable below the ribs and tender. In two of the cases, however, it was absolutely normal. There is usually no history of biliary colic (exception in one case).

The urine is usually dark in color and scanty, and contains urobilin, often in considerable quantities. Bile pigment is usually absent (two exceptions). The icterus, therefore, in the great majority of cases is acholuric. During the paroxysms the temperature is sometimes elevated.

COURSE, DURATION, AND TERMINATION. After an insidious onset the disease, becoming established, tends to become chronic in the majority of instances, and to undergo a series of peculiar variations, in which all of the symptoms, objective and subjective, become alternately aggravated and improved. In order to illustrate these features more definitely, a brief outline of the course of the disease in all the reported cases will be given.

CASE I (Widal).—Following an ischiorectal abscess and proctitis the symptoms insidiously developed at the end of a year. For two years the condition remained stationary. At this time a cholecystectomy was performed for supposed biliary calculi. None were found. The icterus had lasted seven years when she entered the hospital in May, 1907. The disease underwent several improvements and relapses, and did not finally disappear until September, 1908, sixteen

months after admission and over eight years from the beginning of the disease.

CASE II (Widal).—After an abortion in February, 1907, followed by hemorrhages lasting nine weeks, the patient developed the disease and entered the hospital June 20, 1907. For over a year the disease underwent several improvements and relapses. On two occasions the patient left the hospital improved, but returned with symptoms aggravated. Recovery finally took place in September, 1908, fifteen months after admission.

CASE III (Oettinger).—The patient was a rheumatic cardiopath and sufferer from attacks of hepatic colic. The disease developed insidiously over six months prior to admission to the hospital in October, 1908, which she sought on account of a severe bronchitis. The patient developed pneumonia, and died December 14, 1908.

CASE IV (Saquepée).—The patient entered the hospital July 10, 1908, for intermittent fever. The icterus developed on the twelfth, and only lasted eight days. The patient remained four weeks in the hospital, and was discharged cured except for slight anemia. The diagnosis was made on the blood findings.

CASE V (Saquepée).—The patient entered the hospital July 24, 1908, with intermittent fever and a history of malaria for six months. Icterus appeared on the day before entrance, and lasted nine days. The diagnosis was made on the blood findings.

CASE VI (Le Gendre).—The patient was a woman without antecedent disease. Three years before admission to the hospital she developed icterus accompanied by gastric disturbances. At the time of admission the symptoms had improved. She was under observation for nearly four months, and left the hospital practically recovered.

CASE VII (Stejsal).—The patient was a girl with negative antecedents. The disease began insidiously two years before admission to the hospital, November, 1906. During this period the disease had amended and relapsed twice. The patient was under observation intermittently until the spring of 1909, when the symptoms disappeared. During this space of two and one-half years the disease underwent several exacerbations and improvements, and during one of the latter the patient went home and remained for over a year. The disease lasted in all over four years.

CASE VIII (Stejsal).—The patient had pleurisy in childhood; the chest was somewhat deformed. Five months before admission to the hospital, in November, 1908, the disease developed. Undergoing several variations, the patient improved sufficiently at the end of a month to leave the hospital, but suffered a relapse in February, 1909.

CASE IX.—Personal observation (not reported). The disease developed insidiously six months prior to admission to the hospital in July, 1909. The patient was under treatment, in September 1909.

It will thus be seen that with the exception of the two cases of

malarial infection, in which the existence of acquired hemolytic icterus was accidentally discovered upon blood examinations, the cases all show a certain degree of chronicity. The disease in the majority of cases has developed insidiously, often without apparently adequate cause, and after its inception has shown a tendency to endure with varying periods of aggravation and regression for many weeks or months or even years. That the disease tends to recover is demonstrated by the outcome of the cases. In only one instance did death occur, and in this the exitus was due to an intercurrent pneumonia. Recovery in the malarial cases was extraordinarily rapid, and took place in each instance in a little over a week.

PATHOLOGY. The complete hematological examinations which have been made in all of the reported cases have added much to our knowledge of the condition and thrown some light upon its pathology. Two aspects of the blood examinations are to be considered: (1) The globular fragility, and (2) the morphological and miscellaneous changes.

1. *The Globular Fragility.* Acquired ictero-anemia, with its accompanying urobilinuria and splenomegaly, has been found to be hemolytic. The hemolysis seems to depend not so much upon the serum or plasma, nor upon toxic agents contained in these, but upon an absolute increase in the fragility of the red blood corpuscles. Widal and his collaborators found that this fragility existed only when the corpuscles were removed from the blood; that is, deplasmated. Other observers (Stejsal), however, have found the corpuscular resistance diminished in the total blood as well as in mixtures of deplasmated corpuscles, though it was less evident in the former than in the latter.

The technique of the examinations was about as follows: Blood was removed by puncturing a vein or finger tip, collected in an isotonic solution of potassium oxalate, and centrifugated. The plasma being discarded, the corpuscles were washed with 0.9 per cent. solution of sodium chloride. In order to determine the actual resistance of these corpuscles, solutions of sodium chloride in distilled water of different titrations were prepared. To effect this a series of small glass tubes (34 in number) were used. Into these tubes distilled water was placed in progressively increasing amounts, beginning with two drops in the first, 4 in the second, 6 in the third, etc., up to the last, which contained 68 drops of distilled water. Then in the first tube 68 drops of normal salt solution (0.9 per cent.) were placed, in the second 66, in the third 64, etc., until in the last tube 2 drops were put. The tubes were then shaken. The first tube contained, therefore, a solution of sodium chloride 0.68 per 100; the second, 0.66; the third, 0.64, and so on until the last contained 0.02 per 100. A drop of the deplasmated corpuscles was then placed in the tubes, beginning with No. 1, and the exact point noted when hemolysis commenced; that is, when a yellowish tint appeared

in the fluid. This was sometimes found to occur in tube 0.58; intense hemolysis in tube 0.44, and complete hemolysis in tube 0.38. With the total blood in Widal's cases initial hemolysis usually begins in 0.46, intense hemolysis in 0.42, total hemolysis in 0.36, which demonstrated, according to this observer, that the blood corpuscles were abnormally fragile, but that the fragility could only be demonstrated by hypotonic solutions of sodium chloride upon the deplasmalized erythrocytes. Other authors have not reached conclusions identical with Widal in this respect, but all observers have found the globular fragility diminished in every case.

2. *Morphological and Miscellaneous Changes.* A high degree of anemia has been found in every instance. During the exacerbations the oligocythemia may be profound, the lowest number of red corpuscles recorded in the cases being as follows: Case I, 2,340,000; Case II, 1,800,000; Case III, 1,586,000; Case IV, 2,800,000; Case V, 3,000,000; Case VI, 1,125,000; Case VII, 1,100,000; and Case VIII, 2,500,000; Case IX (personal observation), 3,000,000. At the same time the hemoglobin percentage is much reduced, readings of 30 per cent. (Gowers), 30 per cent. (Fleischl), 30 per cent. (Talqvist), being reported. The color index remains high, that is, 1+. The red corpuscles show poikilocytosis, anisocytosis, and polychromatophilia. Normoblasts and megaloblasts are usually present. The percentage of nucleated red corpuscles may rise as high as 5 per cent. Examined in Marciano's fluid, the erythrocytes show protoplasmic refringent granulations. The average diameter of the red corpuscles is increased.

A leukocytosis is usually present. The count in two cases was over 40,000. In five other cases the count exceeded 7500, while in one case it was but 4500. Besides the leukocytosis there is usually eosinophilia and occasionally myelocytosis. The coagulation time is only rarely altered (retarded in one case); and bacteriological examination of the blood is negative. The plasma is darker than normally and usually contains bilirubin.

One autopsy case is reported. Death was due to pneumonia. The liver was not much enlarged, but the spleen weighted 575 grams, was of abnormal shape, and contained several infarcts. Microscopic examination of the liver showed only excess of pigmentation. The spleen showed marked congestion of the pulp, localized exclusively in the columns of Billroth. The bone marrow was found undergoing marked embryonic renovation. In one case (Le Gendre) an auto-agglutination of the red corpuscles was demonstrable; this was regarded by Le Gendre as an aid in the diagnosis, because in this case nucleated red corpuscles were rare and the globular fragility was not strongly marked.

DIAGNOSIS. Although the disease, or syndrome, possesses certain semeiologic characters, which may render the diagnosis probable by their simultaneous presence, it is only by a study of the blood that

this may be rendered certain. It is not necessary to recapitulate the symptoms of the disease, for these have been sufficiently described. The condition must be differentiated from ordinary pleiochromic or retention icterus, from pernicious anemia, and from the congenital form of ictero-anemia (Minkowski-Chauffard syndrome).

Retention icterus will be readily recognized by the acholic stools, the concomitant symptoms of ordinary icterus, as pruritus, bradycardia, etc., and the absence of characteristic changes in the blood.

In pernicious anemia icterus is usually absent. There are apt to be hemorrhages in the skin and mucous membranes, and the symptoms are rapid and progressive. Stejsal points out the fact that the gastric chemism is not altered in hemolytic icterus, as it is in pernicious anemia, in which achylia is the rule. Examination of the blood will reveal an increase in the globular fragility in hemolytic icterus, whereas it does not exist in pernicious anemia.

In the congenital form of ictero-anemia, or so-called Minkowski-Chauffard syndrome, the patients are not much disturbed, and are quite able to attend to their usual avocations. As Chauffard has said, they are icteric rather than ill. The anemia in this condition is usually less marked, and the poikilocytosis and anisocytosis are less intense. The myeloid reaction is very slight, showing only trivial disturbances in the bone marrow. In the acquired form, on the contrary, sometimes as many as 5 per cent. of the red blood corpuscles are nucleated. In congenital icterus the average diameter of the red blood corpuscles is diminished; there is microglobuly. In the acquired form the opposite condition prevails. The chief difference between the two forms, however, lies in the fact that congenital icterus dates from early life or even from infancy or birth.

PATHOGENESIS AND CONCLUSION. The fundamental stigma of hemolytic icterus is the physical or chemical change in the red blood corpuscles, which is manifested by a diminished resistance or so-called globular fragility. This fact in connection with the diminished resistance of the corpuscle toward various lytic agents (Stejsal) proves that hemolytic processes play an important part in the disease and that the anemia is not due to lack of blood formation, but to an increased destruction of the red cells. The latter fact is also proved by the marked signs of renovation in the blood.

The enlargement of the spleen has given rise to the hypothesis that the blood changes are the result of a primary disease of this organ. The variations in the volume of the spleen, coinciding as they do with the oscillations in the degree of the icterus, may, however, with equal probability, be referred to the enormous work imposed upon the organ by the destruction of the corpuscles within the organism. In support of this latter theory it may be said that in experimental hemolysis in animals the spleen has been found enlarged; also, that in the only case in which an autopsy has been

performed, the histological changes in the spleen were undoubtedly secondary to exaggeration of function.

Whether the pigment which produces the icterus is formed exclusively within the blood or entirely within the liver, or by a combination of these processes, is debated. The absence of biliary acids in the blood and in the urine, and consequently of all symptoms of taurocholic intoxication, argues in favor of the first hypothesis, namely, that the pigment is formed within the blood. The blood plasma seems absolutely free from hemolytic power, and therefore plays no part in the hemolysis. The two cases reported by Saquepée prove beyond doubt that the malarial parasite can occasionally increase the globular fragility sufficiently to produce the disease.

In conclusion it may be said that, inasmuch as eight cases of this syndrome have been reported in the past two years, and that others have been observed, although they have not yet found their way into the literature, the clinician should be on the lookout for the disease in all cases of acquired icterus associated with anemia in which the spleen is enlarged, the stools are normal in color, and the signs of taurocholemia are absent. A careful examination of the blood in these cases will settle the question.

TYPHOID BACILLI CARRIERS AND THEIR RELATION TO PUBLIC HEALTH.

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DURING the last five years a large number of cases have been reported, chiefly in Germany, in which persons have been found to discharge typhoid bacilli in their excreta for periods of from six weeks to more than fifty years after an attack of enteric fever. Frosch¹ divides these so-called bacilli carriers into two groups: those who excrete bacilli for less than three months, and those who excrete them for three months and longer. The latter class constitute the chronic bacilli carriers, the "Dauerausscheidern" of the Germans.

That such persons may be a menace to public health has been amply proved by epidemics that have been caused by them. Epidemics due to bacilli carriers are characteristically sporadic in occurrence, are limited in distribution to the immediate vicinity of the carrier himself, or to an area supplied by certain food products

¹ Klin. Jahrb., 1908, xix, 537.

handled by him, and follow the carrier when he moves from one community to another.

Lentz² reports a case in which typhoid bacilli were found in the feces of a patient forty-two years after an attack of typhoid fever. Kutscher³ mentions a patient who excreted bacilli thirty years after an attack of typhoid fever; during this time the patient suffered from cholecystitis.

One of the most famous cases in the literature is that reported by Kayser.⁴ In a certain bakery in Strassburg it was observed that practically every new employee sooner or later became ill with intestinal, typhoid-like symptoms. Among the employees there were two fatal cases of typhoid fever. The blood of the woman who owned the bakery gave a positive Widal reaction in a dilution of 1 to 100. Her feces were found to contain typhoid bacilli. She had had typhoid fever ten years before. In the same city, another woman was engaged in the milk business. Seventeen cases of typhoid, two of them fatal, were traced to this woman, who was proved to be a bacilli carrier. Kayser also reports seven epidemics in a single household, due to a female who had had typhoid fever, complicated by jaundice, thirty years before, and who was still excreting typhoid bacilli. He also discovered six other carriers who were the cause of typhoid fever in others.

Klinger⁵ reports a number of sporadic cases of typhoid fever which occurred in an asylum at Hördt. Inspection of the food and water supply revealed excellent sanitary conditions. Three bacilli carriers were found and isolated. Levy and Kayser⁶ report a very interesting case of a woman who, in 1903, had typhoid fever. During the winter of 1905 typhoid bacilli were found in her stools on ten different occasions.

Nieter and Liefmann⁷ found that typhoid and dysentery had been epidemic for many years in a certain insane asylum in which there were 900 female patients. All attempts to check the spread of the disease by attention to food and water supply failed. Examination of the stools of all the patients revealed seven typhoid bacilli carriers. A year later, Nieter⁸ reported further investigation in this same asylum, and had discovered thirteen carriers among the 900 inmates.

Friedel⁹ reports four epidemics between 1901 and 1905 in the Provincial Hospital of Andernach. Altogether, there were seventy cases. Examination of the milk and water supply gave no clue to the origin of the infection. Examination of the stools of all the patients connected with the kitchen, laundry, and dairy, revealed a bacilli carrier in the person of a sixty-five-year-old female, who had

² Klin. Jahrb., 1905, xiv, 475.

³ Berl. klin. Woch., 1905, xlii, 1620.

⁴ Arbeit. a. d. kaiserl. Gesundheitsämte, 1906, xxiv, 173; *ibid.*, 1907, xxv, 223.

⁵ *Ibid.*, 1905, xxiv, 91.

⁶ Münch. med. Woch., 1906, liii, 2434.

⁷ *Ibid.*, 1906, 53, 111, 1611.

⁸ *Ibid.*, 1907, liv, 1622.

⁹ Hyg. Rundschau, 1906, No. 1, p. 5.

been in the institution for six years, and whose duty it had been to cut the potatoes and prepare the salad. She had never had typhoid so far as known, and had never been sick in the institution. Friedel¹⁰ also reports the case of a female cook who was a chronic bacilli carrier, and who, during eight years, was in eight different families, and apparently caused twenty-four cases of typhoid fever.

Kossel¹¹ describes an epidemic among the customers of a certain dairy, but there was nothing suspicious about the dairy on ordinary inspection. A more thorough investigation revealed a typhoid bacilli carrier in a man who helped in milking. He had worked on the farm for twenty years, and was not aware of having had enteric fever. The proprietor was ordered not to employ this man in any way that would bring him in contact with the milk, and the epidemic immediately subsided. Several months later, another case of typhoid developed among the customers of this dairy, and investigation proved that this same man had been set to milking again.

The British Army Medical Report¹² for 1907 contains a description of an epidemic of eleven cases of typhoid among the soldiers in Kasauli, India. It was found that the soldiers' cook was a bacilli carrier. The research laboratory at that army post found three carriers among "a large number of healthy men," who had nursed cases of typhoid fever but had not themselves suffered from the disease.

Forster¹³ described two epidemics among the customers of two dairies. At each dairy, among those who handled the milk, there was a female bacilli carrier. One of the carriers was the cause of six cases of typhoid fever; the other of seventeen.

Soper¹⁴ relates the remarkable history of a female cook who, in ten years, lived in eight families, in seven of which epidemics of typhoid occurred. There were twenty-six cases in all, with one death. Each epidemic occurred from one to two months after the cook had been employed. In each epidemic the cook herself escaped. The woman refused to give any definite history of herself. Her feces contained bacilli typhoid in abundance.

Hilgermann¹⁵ reports nine bacilli carriers, of which eight were females. Their ages ranged from twenty-one to seventy-one years. Two gave no history of having had typhoid; the others had suffered from the disease from two to thirteen years previous to discovery. One worked in the kitchen, three were housewives; the occupations of the others were not given. All together, they were the cause of typhoid fever in twenty-six other persons.

Davies and Hall¹⁶ described two cases. One was a female cook, who caused four outbreaks among those with whom she was asso-

¹⁰ Ztschr. f. Med.-Beamte, 1907, Heft 6.

¹¹ Deut. med. Woch., 1907, xxxiii, No. 39.

¹² Brit. Army Med. Rep., 1907, xlix, 97.

¹³ Verhandl. der deut. path. Gesellschaft, 1907, p. 163.

¹⁴ Jour. Amer. Med. Assoc., 1907, xlvii, 2019.

¹⁵ Klin. Jahrb., 1908, xix, 463.

¹⁶ Lancet, 1908, ii, 1585.

ciated; the other, a housewife, whose children simultaneously contracted typhoid fever eight months after the mother had suffered a mild attack. Both women were bacilli carriers.

Huggenberger¹⁷ describes the case of a woman who had had typhoid fever thirty years before and whose stools contained typhoid bacilli in great numbers. During this period thirteen members of her household suffered from the disease. The family moved three times, but sporadic cases of typhoid fever always followed.

Gregg's¹⁸ case is one of the most remarkable found in the literature. A seventy-four-year-old female bacilli carrier, who had had typhoid fever fifty-one years before, began to do all her housework and cooking after the death of her husband. He never had typhoid. Very soon after she had begun to take part in preparing the food for the table, cases of typhoid fever began to occur among her boarders. In two years, seven boarders suffered from attacks of the disease.

Dean¹⁹ reports the case of a physician who was found to be discharging typhoid bacilli twenty-nine years after having had the disease.

Chalmers²⁰ gives the history of an epidemic of typhoid among the customers of a Glasgow dairy, traceable in part to a chronic bacilli carrier, and in part to a typhoid patient, among the employees of the dairy, who contracted the disease from the carrier. An epidemic of twenty-eight cases among the inmates of a reformatory was traced by Branthwaite²¹ to a dairymaid who had had typhoid fever six years before.

Scheller²² describes two interesting cases. In one of these the infection was carried in cold victuals infected by a male bacilli carrier. In the other, it had been noted that during fourteen years there had occurred seventeen cases of typhoid among the customers of a particular dairy near Königsberg, the remainder of the town remaining practically free from the disease. Investigation revealed a bacilli carrier in the person of a milkmaid, who had had typhoid fever seventeen years before, and had been employed in the dairy for fourteen years.

Albert²³ reported a mild epidemic in three families, all of whom obtained their milk from the same source. The milker was found to be a bacilli carrier. No one else in the town bought milk from this man, and the cases of typhoid were limited to his customers.

During the fall of 1908 a severe epidemic of typhoid fever occurred among the inmates of the Indiana State Reformatory at Jeffersonville. Seventy-two persons were affected, with eight deaths. An examination at the time indicated that the epidemic resulted from

¹⁷ Correspondenzblatt f. Schweiz. Aertze, 1908, xxxviii, 622, Abs. in Lancet, 1908, ii, 1163.

¹⁸ Boston Med. and Surg. Jour., 1908, clviii, 83, 143.

¹⁹ Brit. Med. Jour., 1908, i, 562. ²⁰ Ibid., 284 and 701.

²¹ Ibid., 701.

²² Centralbl. f. Bakt., Erste Abtl., Orig., 1908, xlv, 385.

²³ Jour. Amer. Med. Assoc., 1908, li, 982, Discussion of Dr. Park's paper.

the pumping of Ohio river water into the water-mains on the occasion of a fire at the Reformatory. On the discovery of the cause, the Reformatory mains were immediately cleaned, and no more cases developed. On account of the danger of the disease becoming endemic from the presence of typhoid bacilli carriers, it seemed wise to examine the dejecta of all the ex-typhoid fever patients in the institution. This was done on April 15, 1909, about six months after the epidemic.

Dr. H. H. Smith, physician at the Reformatory, had planned and executed all the details of preparation with great care. He collected the stools of each ex-patient in a sterile vessel, and the urine in a sterile bottle. Specimens from sixty-four patients, all of whom were males, were obtained.

Cultures were made directly from the feces and urine into tubes of lactose bile. These were taken to the laboratory and incubated over night. On the next morning, plates were made from each tube, Hesse agar being the medium used. This is a semisolid medium, and in it typhoid bacilli, on account of their greater motility, form very large thin colonies, which is said to distinguish them from colonies of *Bacillus coli*, which are smaller and more compact. Cultures were made from every large thin colony on the plates, but typhoid bacilli were found in none of them. Many were *Bacillus pyocyaneus*, some were *Bacillus coli*, and some were other bacilli that were not identified. On the whole, this medium did not prove as satisfactory as Jackson and Melia²⁴ claimed to have found it. The size of the colonies, which is the characteristic feature, seems to depend not so much on the type of organism as on the position of the colony in the medium. A colony of *Bacillus coli*, or of almost any other organism, growing on the lower surface of the agar, between it and the bottom of the plate, will, probably influenced by capillary attraction, spread out quite rapidly and form a colony resembling very closely that of *Bacillus typhosus*. However, since cultures were made from all large, suspicious looking colonies, it is probable that if typhoid bacilli had been present they would have been found. That bacilli carriers were not found among these patients, was not especially surprising, as will be shown below.

The fifty-one bacilli carriers collected above were the cause of not less than 275 cases of typhoid fever in others. In 1904 and 1905, Kayser found that of 205 cases of typhoid in Strassburg, twenty-eight were traceable to "healthy" carriers. From 1904 to 1906, inclusive, Frosch found 276 cases of typhoid, traceable to 310 carriers, discovered during that time. During the same period, 6708 cases of typhoid occurred. Thus, 4.1 per cent. of all the cases were caused by bacilli carriers. In 1906, in Strassburg, there were 2080 persons sick with typhoid fever; 978 cases (47.7 per cent.) were

²⁴ Jour. Infec. Dis., 1909, vi, 194.

traced to their source, and of these, 746 were so-called "contact infections." Forty-nine of these cases were caused by bacilli carriers; thus, 2.4 per cent. of all cases, or 5 per cent. of those the sources of which were discovered, were due to bacilli carriers.

That bacilli carriers may be a genuine source of danger to the community is abundantly proved by the cases and statistics given above. But that their importance in spreading infection may easily be exaggerated is equally true. A sufficient number of cases has now been reported to justify drawing some tentative conclusions.

It is important, first of all, to determine approximately what percentage of typhoid-fever patients ultimately become bacilli carriers. The opinion of different investigators varies greatly.

In 1908 Park²⁵ found four carriers among sixty-eight persons—that is, in 6 per cent.—who had had typhoid fever more than six months before the examination was made. Lentz believes that 4 per cent. of ex-typhoid patients become bacilli carriers. In 482 cases of typhoid, Klinger²⁶ found that only eight (1.7 per cent.) continued to discharge bacilli for more than six weeks after the temperature became normal. He discovered twenty-three carriers in a little more than two years; all of these yielded bacilli in the stools, and eight in the urine. Among 154 cases of typhoid, Brion and Kayser²⁷ found that 7 per cent. still discharged typhoid bacilli in their stools after fifteen days of normal temperature. In another series of 200 cases, these authors found that 1.5 per cent. became chronic bacilli carriers. Kayser²⁸ found that in Strassburg 3 per cent. of all typhoid patients were discharging bacilli one year after the attack. Frosch collected the results of examinations of the excretions of 6708 ex-typhoid patients. Of these, 310, or 4.6 per cent., continued to excrete the bacilli for more than ten weeks, and of this number, 166, or 2.47 per cent. of the total, became chronic bacilli carriers.

On the basis of the figures just given one would have expected to find typhoid bacilli in the feces of less than three of the patients examined by me. Three out of every four bacilli carriers are females. Hence, the chance of finding a bacilli carrier among the sixty-four young male patients six months after the attack of typhoid fever was rather small.

It is not necessary that a person shall have suffered from a clinically evident case of typhoid fever for him to become a bacilli carrier. Flexner²⁹ has called special attention to the fact that a "typhoid fever . . . may exist with very trifling symptoms, and may sometimes run so insidious a course that the condition might easily escape notice." In 1897, Remlinger and Schneider³⁰ claimed to have isolated *B. typhosus* from the stools of persons who had never suffered from typhoid fever. Klinger found twelve car-

²⁵ Jour. Amer. Med. Assoc., 1908, li, 981.

²⁶ Deut. Arch. f. klin. Med., 1906, lxxxv, 525.

²⁷ Johns Hopkins Hosp. Rep., 1900, viii, 241.

²⁸ Loc. cit.

²⁹ Loc. cit.

³⁰ Ann. de l'Inst. Pasteur, 1897, xi, 63.

riers, and at the laboratory of the British Army Post at Kasauli, India, there were found three, who gave no history of having had enteric fever, although all of them had been in close contact with typhoid patients. Of the fifty-one bacilli carriers collected above, fifteen denied ever having had typhoid fever.

Sex appears to be a factor of much importance in the etiology of bacilli carriers. Among those discovered by Kayser³¹ there were twice as many females as males. Scheller³² found twelve females among eighteen bacilli carriers, and Hilgerman³³ found eight among nine. The German Royal Commissioners in a large number of cases found that 82 per cent. of bacilli carriers were women.³⁴ Among the fifty-one cases here collected, there were forty females and eleven males. It is a significant fact that the ratio between the sexes among bacilli carriers is very nearly the same as that found in cholelithiasis.

The discharge of typhoid organisms in the excreta of bacilli-carriers is intermittent. The character of the diet does not seem to have any influence on the occurrence of bacilli in the stools of carriers,³⁵ but there does seem to be some relation between unformed and semidiarrheal stools and the presence of typhoid bacilli.

Not only is the discharge of bacilli intermittent, but the "effectiveness" of bacilli-carriers for infecting others is likewise intermittent. Just why this is true has not been discovered. Hilgerman believes this condition due to variations in virulence of the organism, there being a somewhat fluctuating, but on the whole a steady tendency toward complete loss of virulence, due to the prolonged parasitic life of the given strain of bacilli. Conradi³⁶ believes that "the opportunity of infection from a single contact with a bacilli carrier is most favorable either when a notorious bacilli carrier enters a strange house, or a stranger enters the house of a notorious bacilli carrier." Soper's case is an excellent example of this principle.

Davies and Hall³⁷ think that there is a seasonal variation in the "effectiveness" of bacilli carriers. During the early months of the year they noted an almost uniform absence of "effectiveness," which began about May and continued, more or less intermittently, until November or December. In this connection it is interesting to note that the four epidemics traced by Friedel to a bacilli carrier occurred in May, 1901; October, 1901; May, 1905; and September, 1905, respectively. This period of "effectiveness" is seen to correspond to the warm months of the year, and its real explanation, as suggested by Martin,³⁸ may be that during the warm season bacteria will multiply easily in certain food products, and the persons eating them will thus get larger doses of bacilli than in the cold months.

³¹ Loc. cit.

³² Loc. cit.

³³ Loc. cit.

³⁴ Quoted by Frosch, loc. cit.

³⁵ Pratt, Peabody, and Long, Jour. Amer. Med. Assoc., 1907, xlix, 846.

³⁶ Klin. Jahrb., 1907, xvii, Heft 2.

³⁷ Loc. cit.

³⁸ Lancet, 1908, ii, 525, Discussion of Davies and Hall's paper.

One of the most significant facts brought out by an analysis of the cases collected is that the occupation and social condition of the carrier has much to do with the likelihood of his spreading typhoid fever. Most of the epidemics occurred among the lower classes, among whom cleanliness is, to say the least, not a virtue. In this group of cases the occupations of thirty-three bacilli carriers were given, twenty-one of whom had caused typhoid fever in others. There were thirteen dairy workers, nine cooks, seven housewives, and three laundresses. From this it would appear that those carriers are most dangerous whose work brings them into contact with food products.

That the gall-bladder is a most important factor in the etiology of chronic bacilli carriers is proved by both clinical and experimental evidence. As early as 1829 Louis³⁰ pointed out the not infrequent occurrence of cholecystitis accompanying or following typhoid. Long before bacilli carriers had been thought of, Raimond and Faitout,⁴⁰ Fournier,⁴¹ von Dungern,⁴² Cushing,⁴³ Miller,⁴⁴ Droba,⁴⁵ Hunner,⁴⁶ and others had found typhoid bacilli in the gall-bladder, associated with cholecystitis or cholelithiasis, from three months to twenty years after an attack of typhoid fever. I once isolated typhoid bacilli from the gall-bladder of a patient operated on for gallstones, ten years after he had had typhoid fever. Blackstein⁴⁷ and Welch⁴⁸ and Forster and Kayser⁴⁹ injected typhoid bacilli into the ear vein of rabbits and recovered them from the bile of the gall-bladders one hundred and twenty-eight, and forty-two days later, respectively. All other organs of these animals were free from bacilli. Nieter and Leifmann⁵⁰ and Levy and Kayser⁵¹ found typhoid bacilli in great numbers in the gall-bladders of two bacilli carriers who came to postmortem. Dehler⁵² performed cholecystotomy on two bacilli carriers who showed no gall-bladder symptoms, and found typhoid bacilli in abundance.

During the course of typhoid fever, the bacilli reach the liver through the circulating blood, and from this pass into the bile and on into the gall-bladder. Josef Koch⁵³ examined the wall of the gall-bladder of a patient with cholecystitis, dying in the third week of typhoid. He found bacilli in the mucosa of the gall-bladder and concluded that the infection reached the mucous membrane through the blood stream, and that the bile became infected from the mucous

³⁰ *Recherches sur la fièvre typhoïde*, Paris, 1829; quoted by Chiari, *Verhandl. d. deut. path. Gesellschaft*, 1907, p. 145.

⁴⁰ *Compt. rend de la Soc. de biol.*, 1896, quoted by Chiari, l. c.

⁴¹ Quoted by Chiari, l. c.

⁴² *Münch. med. Woch.*, 1897, No. 26, p. 629.

⁴³ *Johns Hopkins Hosp. Bull.*, 1898, ix, 91.

⁴⁴ *Ibid.*, p. 95.

⁴⁵ *Wien. klin. Woch.*, 1899, No. 46; quoted by Chiari, loc. cit.

⁴⁶ *Johns Hopkins Hosp. Bull.*, 1899, x, 163.

⁴⁷ *Ibid.*, 1891, ii, 96.

⁴⁸ *Ibid.*, p. 121.

⁴⁹ *Münch. med. Woch.*, 1905, No. 31; quoted by Chiari, l. c.

⁵⁰ *Ibid.*, 1906, liii, 1611; *ibid.*, 1907, liv, 1622.

⁵¹ *Ibid.*, 1906, liii, 2434.

⁵² *Ibid.*, 1907, Nos. 16 and 43.

⁵³ *Centralbl. f. Bakt., Beilage zu Abt., i*, 1908, xlii, 54.

membrane. This is quite contrary to the view generally held. Ziegler,⁵⁴ discussing Koch's paper and sections, stated it as his opinion that bacilli first appeared in the bile and passed from there into the mucosa, just as gonococci get beneath the epithelium lining the urethra.

Drigalski⁵⁵ has shown that the bile exerts no restraining influence on the growth of *Bacillus typhosus*, and, as pointed out by Pies,⁵⁶ when some albuminous substance, such as an inflammatory exudate, is added, bile becomes a very favorable medium for the growth of this organism. These conditions easily arise after typhoid fever. Just as about 90 per cent. of persons who have gallstones never suffer any particular inconvenience therefrom, so chronic bacilli carriers may harbor typhoid bacilli for years without showing any symptoms referable to the gall-bladder. In this series of collected cases, gall-bladder symptoms are mentioned in only three.

On the other hand, there is strong evidence to the effect that in occasional cases the persistence of typhoid bacilli in the stools is due to the multiplication of the organisms in the lumen of the intestine itself. Drigalski,⁵⁷ Friedel, Rosenau,⁵⁸ and others have obtained typhoid bacilli in almost pure culture from the stools of bacilli carriers. In some cases they may entirely replace the colon bacilli, normally found in feces.

The question of the proper handling of chronic bacilli carriers is an important one. A number of measures have been suggested and given more or less trial. Dehler⁵⁹ did a cholecystotomy on two cases, with complete disappearance of typhoid bacilli from the stools. This treatment, of course, is too radical for general use, especially since Forster⁶⁰ mentions the case of a paratyphoid bacilli carrier on whom a cholecystotomy was done for gallstones without disappearance of bacilli from the stools.

After Crowe⁶¹ reported that hexamethylenamin, when given in doses of 75 grains per day, is excreted in the bile, and "exercises a decided bactericidal action," it was thought that the administration of this drug would furnish an effective method of dealing with chronic bacilli carriers. But results have not come up to expectations. The patient originally described by Soper received from 100 to 150 grains of hexamethylenamin a day without effect.⁶²

Isolation, which in some cases would be equivalent to imprisonment for life, would be unjust and probably would not be tolerated. At last report, Soper's patient had been kept in confinement for sixteen months without results.

⁵⁴ Ibid., S. 56.

⁵⁵ *Centralbl. f. Bakt., Erste Abtl., Orig.*, 1904, Band xxxv, quoted by Chiari, loc. cit.

⁵⁶ *Arch. f. Hyg.*, 1907, Band lxii, S. 107; quoted by Forster, *Verhandl. der deut. path. Gesellschaft*, 1907, p. 166.

⁵⁷ Loc. cit.

⁵⁸ Jour. Amer. Med. Assoc., 1908, li, 882, discussion of Dr. Park's paper.

⁵⁹ Loc. cit.

⁶⁰ Loc. cit.

⁶¹ Johns Hopkins Hosp. Bull., 1908, xlx, 109.

⁶² Park, loc. cit.

As already pointed out, the majority of bacilli carriers who have been the cause of typhoid fever in others, have been persons who handled certain food products, especially those used in a raw state. This suggests a practicable way of dealing with a source of infection of this kind. When a bacilli carrier is discovered among the employees of a dairy, restaurant, or other food-producing or food-distributing establishment, such an employee can be compelled, under the new health laws of Indiana, to seek other employment. The danger of his spreading infection will thus be greatly reduced, although not entirely eliminated.

In conclusion, and by way of summary, I may say, first, there is ample evidence for considering the danger of the spread of typhoid fever by chronic bacilli carriers as worthy of the attention of health officers; second, epidemics caused by bacilli carriers are characterized by the occurrence of small groups of cases at intervals of a few months in the immediate vicinity of the carrier, or in the territory supplied by some food product handled by him; third, the most practicable way of reducing the danger to the public from these individuals is by excluding them from work that brings them in contact with food products.

CHRONIC NEPHRITIDES, DUE TO ACUTE SYSTEMIC INFECTION.

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IN spite of the universally accepted fact that chronic renal disease may be one of the more or less remote sequences of a systemic infection, it is, nevertheless, true that entirely too little attention has been and is bestowed upon the connection between acute systemic infection, that is, the transmission of the infective agent by the blood current, and a considerable number of permanently injured kidneys. The infectious origin of a chronic nephritic state is generally only then recognized when it has developed as the direct continuation of an attack of acute or subacute nephritis that has arisen on the basis of an acute infection, or when the chronic nephritis has supervened in the course of long-established or chronic instances of infections like malaria, tuberculosis, or syphilis.

It has ever been the dictum of experienced clinicians that urinary findings like albumin, large numbers of blood cells and renal epithelium, and epithelial and granular casts can be attributed to a systemic infection of the kidney only when originating in the course of a pronounced acute infectious disease. While this clinical viewpoint leaves nothing to be desired as far as conservatism is concerned, the

physician generally cannot furnish any other but clinical evidence that in a given case the renal involvement is due to a systemic invasion. To prove positively a causal connection in such instances is extremely difficult or well nigh impossible when the patient remains alive, and the necropsy may or may not reveal the specific pathogenic bacteria in the kidneys. Still more difficult it would be to establish an etiological relationship between an existing chronic nephritis and a systemic infection that had been of a more or less transitory nature.

In cases of this kind the effect endures while the cause has been removed months or even years ago, and it is, of course, out of the question to be able to demonstrate the original *materia peccans* in either blood or kidneys. Nevertheless, the great amount of accumulated clinical evidence prompts us to regard acute systemic infection as one of the causes of chronic renal disease.

The scope of this article is limited to a consideration of the relationship of acute systemic infection to chronic nephritides; it embraces, therefore, clinical experiences concerning acute infectious diseases, like scarlet fever, diphtheria, pneumonia, influenza, measles, etc., which may give occasion to chronic renal damage, but does not include any data anent renal involvement as the consequence of gonorrhea and affections starting from the lower genito-urinary tract, which may invade the kidneys in a direct manner, and chronic infections like tuberculosis, syphilis, or chronic forms of malaria.

The typical renal involvement concomitant with or following an acute infectious disease is of a parenchymatous nature. The chronic nephritic states evolving from the acute processes, it stands, therefore, to reason, tend to assume or rather to perpetuate this parenchymatous character. Roughly speaking, however, not more than 50 per cent. of the pertaining chronic nephritides are predominatingly parenchymatous. In about 20 per cent. of the cases indurative processes follow in the wake of acute parenchymatous inflammation, or supervene in the presence of subchronic or chronic parenchymatous states, and in at least 30 per cent. of the cases amyloid lesions concur with the original parenchymatous affection.

The lesions in some forms of acute nephritis are of brief duration, and the kidneys recover their normal state and function just as do the lungs after an attack of lobar pneumonia. Other types of acute nephritis are characterized by lesions tending to chronicity, and the original condition of the kidneys will never be restored. In nephritides ensuing in or following scarlatina and diphtheria, some of the lesions are usually of a permanent nature; the same is also the case in nephritic states due to other acute infectious diseases, although the permanent lesions occur here much less frequently and are generally of a milder degree. With these irreparable lesions as a foundation, true nephritis of a chronic nature will sooner or later supervene in nearly every case.

The direct transformation of an acute nephritis into a chronic form has been observed in comparatively few instances only; however, the successive transition from an acute nephritic process through subacute and subchronic stages, to the chronic condition can be traced clinically with more or less accuracy in a considerable number of cases. The successive transformation may occur within some weeks or may take many years. When the process is diffuse and purely parenchymatous, it has the disposition rapidly to assume the chronic form.

There are cases in which a chronic nephritis is not recognizable for long periods, in which there is no demonstrable connection between an acute renal inflammation which has occurred many years previously and an existing chronic nephritis. In such instances we may have to deal with indurative processes of varying degree and intensity. Renal induration may either set in when the parenchymatous nephritis is still fresh, or it may not be called forth until it has progressed to a certain stage. It is also possible that latent or limited indurative metamorphosis is occasionally present prior to the establishment of the parenchymatous inflammation, and that the latter stands at the foundation of a renewed or greater activity of the process of induration. Preëxisting indurative lesions, however, bear a primary and not a secondary character, as do the particular indurative occurrences under consideration.

Secondary renal induration, which finally leads to sclerotic kidney, may form a terminal stage of either acute, subacute, or subchronic conditions of parenchymatous inflammation. After a time, the indurative process which has brought the parenchymatous degeneration to a standstill, may itself attain a certain degree of latency. It is during this period of comparative latency, which may occasionally endure for a number of years, that the existing renal lesions remain often unrecognized, and that the connecting traces between the original acute renal inflammation and an eventual conspicuous final nephritis become more or less obliterated. On account of the concealed syndrome during the latent period of induration, the final nephritis which evinces itself not only by the urinary findings, but also by well-authenticated systemic phenomena, is often erroneously held to be a comparatively new affection. This is especially the case when the patient has just passed through an attack of illness, which may have stimulated the old nephritic process to renewed activity. At other times, the manifest nephritic state has been described, especially by the patient himself, as being of spontaneous production.

An acute infectious disease may thus be the original cause of a chronic renal affection in which indurative processes predominate. Progressive renal induration occurs so frequently in the absence of any determining systemic factor and in individuals who had at one time been affected with an acute infectious nephritis, that I have to

reiterate my opinion, expressed on a former occasion,¹ namely, that the majority of chronic interstitial nephritides, not due to constitutional causes, is the consequence of an acute infectious disease.

The affected kidneys become readily subject to amyloid degeneration. This may ensue on top of the diffuse (parenchymatous) processes within a few months after the onset of the latter. The amyloid transformation, however, which interests us most on this occasion is that which occurs together with chronic parenchymatous or secondary indurative nephritis. Amyloid degeneration of the kidneys, always supervening in both organs, is never a primary process. It is nearly always produced in the wake of certain cachectic conditions, the underlying abnormal blood composition of which may have been evoked by long-continued renal disease. Not infrequently amyloid kidney is mistaken for parenchymatous or indurative nephritis. With the former it has, in common, the large amount of urinary albumin, with the latter the scanty number of morphotic elements in the urine; these consist in the greater part of hyaline and finely granular casts. In the rarest of instances amyloid degeneration is traced back to an acute nephritic attack.

The history of an individual with chronic nephritis will often reveal the fact that he has at one time been afflicted with an acute nephritis, following an attack of an infectious disease like scarlet fever, diphtheria, pneumonia, influenza, measles, erysipelas, rheumatic or typhoid fever, smallpox, parotitis, etc., and that soon afterward the nephritic symptoms have vanished. In many of the pertaining cases, however, there ensued but a temporary arrest of the nephritis, and in the absence of subsequent urinary examinations, this temporary cessation was translated to mean a permanent amelioration. Furthermore, the abatement of the albuminuria has been, and still is often, interpreted as the abatement of the nephritic process itself, a misconception of facts to which many a fatality has to be ascribed. Albuminuria may occur without any inflammatory renal changes, as I have again shown in a recent communication,² and in certain nephritic states the albuminuric phenomenon may not ensue at all for a long period or may be temporarily suspended.

The records of the last 200 cases of chronic nephritis that have come under my observation give the history of one or more acute infectious diseases at some period during the life of the patients in 192 instances. Among these an acute renal involvement had been positively set up in at least 121 cases. Moreover, the histories following the attack of the infectious disease in 56 or 58 of the remaining cases strongly point to the occurrence of an acute nephritic process. (Among these should be included 4 cases of tuberculosis, 5 cases of syphilis, and 1 case of chronic malaria.) Ignoring, however, all the

¹ Heinrich Stern, The Renal Complications and Sequelæ of Influenza, *Med. Rec.*, January 11, 1908.

² Heinrich Stern, Compensatory Albuminuria, *Med. Rec.*, June 26, 1909.

unconfirmed instances, we find that renal involvement had existed in 62.5 per cent. of the cases that had been acutely infected. The frequency of renal involvement after the various infectious diseases was as follows: scarlet fever, 38 cases; diphtheria, 35 cases; influenza, 16 cases; pneumonia, 12 cases; measles, 12 cases; typhoid fever, 6 cases; rheumatic fever, 1 case; erysipelas, 1 case.

The chronic nephritic processes evolved from or supervening some time after the occurrence of the 121 positive acute nephritides exhibited a preponderating parenchymatous character in 58, the features of secondary induration in 24, and of amyloid degeneration in 39 instances.

Of the 200 quoted instances of chronic nephritis, 156 occurred in men, and 44 in women. This, however, is not the normal proportion of the sexes as affected by chronic nephritis, for the reason that my records comprise the histories of a comparatively large number of male applicants for life insurance who were referred to me after they had been rejected by the examiners of the companies. The age of the youngest individual was eight, of the oldest, sixty-four years.

The 121 cases of chronic nephritis furnishing a positive history of acute renal involvement during or after an infectious disease, had ensued in 97 men and 24 women. The ages varied between eight and forty-nine years. (None of the older individuals could produce definite data concerning the acute nephritis in the wake of an infectious disease.) The time which had elapsed since the occurrence of the acute nephritic state amounted to from ten months to twenty-six years. As a matter of course, the indurative instances were those which had lasted longest.

From the foregoing remarks it does by no means follow that an acute nephritis of infectious origin always stands in direct relationship to a chronic nephritic state that supervenes in after years. However, we are justified in assuming that kidneys, acutely affected at one time, are thereafter possessed of a lowered degree of resistance in many, and of a diminished functional activity in some, of the instances. Exciting causes which will not readily affect the entirely sound kidney to any extent, bear upon a weakened organ and tend to call forth therein further damage. Exposure to telluric conditions of cold and dampness, continued physical and mental strain, excesses in *baccho et venere*, factors which are generally held to be excitants of renal disease, will be conducive to the production of nephritis in proportion to the lack of resistance of the kidneys. Even the slightest provocation may affect the non-resistant kidney and occasion intermittent or permanent manifestations of an active morbid process. While, therefore, an acute nephritis is not necessarily followed by a chronic degenerative renal state directly traceable to it, it evidently prepares the soil for subsequent invasions and textural and functional decline.

The following conclusions are offered:

1. Kidneys, acutely affected at one time, are thereafter possessed of a lowered degree of resistance in many, and of a diminished functional activity in some, of the instances.

2. It is very difficult, so far as positive demonstration is concerned, to establish an etiological relationship between an existing chronic nephritis and a systemic infection that had been of a more or less transitory nature. Clinical evidence, however, prompts us to regard acute systemic infection as one of the causes of chronic renal disease.

3. The typical renal involvement concomitant with or following an acute infectious disease is of a parenchymatous nature. About half of the chronic nephritides evolving from nephritic processes that have originated during or after an acute infectious disease, are predominatingly parenchymatous; in about 20 per cent. of the cases indurative processes follow in the wake of acute parenchymatous inflammation, or supervene in the presence of subchronic or chronic parenchymatous states; and in about 30 per cent. of the cases amyloid lesions concur with the original parenchymatous affection.

4. The direct transformation of an acute nephritis into a chronic form has been observed in comparatively few instances only; however, the successive transition from an acute nephritic process through subacute and subchronic stages to the chronic condition can be traced clinically with more or less accuracy in a considerable number of cases.

PERNICIOUS ANEMIA, WITH REMISSION FOR SEVENTEEN YEARS.

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THE object of this article is chiefly to record a case of pernicious anemia, in which there was a remarkably long period of complete remission of symptoms, amounting to a cure for some sixteen years, with final relapse, showing all the characteristic symptoms and pursuing a truly progressive course to a fatal ending.

The case, that of a physician, was one of five previously reported.¹ At that time Dr. P., aged forty-nine years, was engaged in a large country practice. He had been losing strength and growing anemic for a year or two. He became much worse, and was compelled to cease work in the spring of 1889; he soon became very ill, with a temperature of 104° F. and marked delirium. There was severe

¹ Medical News, October 11, 1890.

vomiting and diarrhoea. The skin was very pale, but with a decided lemon tinge. The blood showed the characteristic appearances of pernicious anemia; 730,000 red blood corpuscles per cubic millimeter. There were retinal hemorrhages in both eyes. He had recurrent chills irregularly, with high temperature, delirium, vomiting, and diarrhoea for nearly three weeks, after which he began to improve, slowly at first, but later more rapidly. Arsenic was given early and gradually increased until 45 minims of Fowler's solution was taken daily. In a month the corpuscles reached 1,700,000, and at the end of another month 3,250,000. His general condition was correspondingly improved. Five months later he was apparently quite recovered and able to resume his practice. His blood contained then nearly, if not quite, the usual number of practically normal red corpuscles per cubic millimeter. He remained well and in constant practice until the autumn of 1906, when he found himself growing weak and unequal to his work. When examined in the following March, 1907, he was very weak, the body surface markedly yellowish, the appetite poor, the bowels constipated, with occasional diarrhoea. The blood contained 1,926,000 red corpuscles per cubic millimeter, of large size generally; poikilocytosis was marked, and both normoblasts and megaloblasts were present. The hemoglobin was 39 per cent.; white corpuscles, 4200; lymphocytes, over 30 per cent.; few eosinophiles. He improved rapidly, and by the end of a month there were over 3,000,000 red corpuscles per cubic millimeter; no megaloblasts were found, and the eosinophiles were numerous.

In the early summer there were over 4,000,000 red corpuscles per cubic millimeter, and he was feeling correspondingly improved. He went to the Canadian Northwest as far as the Rocky Mountains in the summer. While travelling, vomiting and diarrhoea were troublesome, and he became much prostrated. With rest he improved steadily and was fairly well on his return in November. He was not seen until January, 1908. He looked well, although his strength was failing since his return from the West; appetite was fair; tongue clean, no stomatitis, gums healthy, teeth having been removed some years previously. He had some diarrhoea for a day or two, about every two weeks; stools liquid, but not offensive. The blood contained about 3,500,000 red corpuscles per cubic millimeter, showing only slight variation in size and shape. From that time on his condition became generally worse, with slight improvement for a few days from time to time. He had frequent recurrences of vomiting and diarrhoea, the stools being copious and liquid. During the month before he died he was scarcely more than semiconscious; his general condition was that of marked pernicious anemia. Death took place May 17, 1908, at the age of sixty-eight, over twenty years after the first symptoms of his first attack showed themselves. He recovered from the first attack in the autumn of 1889, and continued in good health until 1906, a period of seventeen years. During these

years there was no opportunity for making an examination of his blood or general condition, as he felt in very good health and his capacity for work was excellent. He, therefore, considered examinations unnecessary. After his death, unfortunately, there was no opportunity for an autopsy.

So far as I can determine from the literature of pernicious anemia, the duration of the disease and length of complete remission during which he was in good health, are much the longest on record. The recovery from the first attack had been of such long duration that I had for years regarded it one of complete and permanent recovery. "Call no man happy until he is dead" is certainly applicable to pernicious anemia. Had he died a year or two earlier from some intercurrent illness, such as pneumonia, or by an accident, his case could, with good reason, have been recorded as one of permanent recovery from pernicious anemia. As to the justice of such a conclusion much will depend on the definition we give of a recovery. In the acute diseases, and in many chronic ones, recovery takes place and later another attack occurs from a subsequent infection, as, *e. g.*, in pneumonia, erysipelas, and malaria among the acute, and tuberculosis and even syphilis among the chronic diseases. If we apply the same reasoning to pernicious anemia, some cases doubtless do recover, and this case should be included in the list, as there is scarcely a doubt that his blood would have shown a normal appearance during those years of good health, had it been examined.

It is probable that all the cases of permanent recovery on record have also suffered a relapse if they were not cut off by some intercurrent disease. One can scarcely agree with the statement that "When a patient has been six years free from trouble it seems safe to conclude that no recurrence will occur," or that any such group of cases demonstrate the possibility of permanent recovery.² Exception must be made of the puerperal cases. One such was included in the five reported in 1890.³ This woman made a complete recovery and has remained well since. The diagnosis as one of pernicious anemia was at least doubtful, and was so regarded at the time; the subsequent history renders it probable that the anemia was due to toxemia caused by the unsanitary conditions of the house in which she was then living.

This case affords a striking illustration, in the first place, of the uncertainty of the course and duration of pernicious anemia, and, in the second place, of the certainty of the final ending, if the sufferer in the meantime does not succumb to some intercurrent affection. In a number of cases the toxemia and prostration are so great at some period of their history, that death has been daily expected, and yet, without apparent cause, they have improved and become able to be about in a few days, after which improvement has often

² Osler's Modern Medicine, v, 635.

³ Loc. cit.

been rapid and they have been able to resume their usual occupations. In the case of a stone mason some years ago, the prostration was so great that he was unconscious, blood-stained saliva flowed freely from the mouth, coloring the pillow, and neither food nor liquid could be given. He was, in fact, apparently *in extremis*. Yet a day later he became conscious, took food, sat up, and in two more days travelled one hundred miles to his home. He resumed his work in a few weeks, and spent an active summer. He failed again gradually during the ensuing winter and died in the spring. The designation given by Biermer of *progressive pernicious anemia* is quite inappropriate, as the disease is nearly always remittent and not progressive, in many the remission being marked and of long duration.

In addition to the irregularity in its progress, the course of the disease presents the greatest variations in symptoms. In some, and these are the most numerous cases, the digestive tract shows marked and frequent disturbance, with vomiting and diarrhoea. The stools are usually watery, and may be offensive, owing to copious secretion into the intestine and vigorous peristalsis. The mouth, as a rule, is healthy. In some cases there is, from time to time, troublesome superficial glossitis, but in none of my cases have there been the septic gums met with so often by Hunter and regarded by him as the source of the infection, which causes the disease, or, as he believes, one variety of it. In the case of Dr. P. the teeth had been removed some years before the symptoms began, and the gums were quite healthy. Well-fitting false teeth had been worn.

Signs of local disease may be slight or absent. A fair percentage of cases show early and marked symptoms of degeneration in the nervous system, any part of which may be affected. The peripheral nerves most frequently suffer as shown by local paresthesias, anesthesia, and trophic changes, especially in the skin, which not rarely presents a glossy surface and other signs of atrophy. The spinal cord is frequently affected, especially in the posterior columns, hence some ataxia. The altered sensations and anesthesia may also be due to cord changes. In a few cases the brain suffers, as shown by well-marked mental disturbance which may persist even when the patient's general condition has greatly improved. A few years ago, in the case of a physician, mental symptoms occurred early and persisted in varying degrees, even when he had improved so much that the blood contained nearly 5,000,000 red blood corpuscles per cubic millimeter, and they were of nearly normal appearance.

As to the benefit of arsenic in pernicious anemia, opinions vary. By many it is regarded as of great importance, almost as a specific; by others, an increasing number, it is looked upon as having possibly a little influence on the progress of some cases, but that it is of no benefit in the majority. Arsenic is supposed to act as a stimulant to the blood-forming tissues, increasing the production of red cor-

puscles. Gunn⁴ ascribes to it the effect of rendering the stroma of the red corpuscles more resistant to destructive agencies. It has appeared to me that in the more acute cases, if in any, arsenic has a beneficial effect. In these there are the symptoms of an acute toxemia, such as fever, vomiting, diarrhoea, and often delirium. These cases not rarely bear arsenic well, as soon as the vomiting and diarrhoea have ceased, and improvement is often rapid. In such cases the symptoms are chiefly, if not altogether, due to the toxemia. In the more chronic cases with progressive symptoms, often without any acute irritative attacks, but running a slow downward course, arsenic seldom has any beneficial influence; on the contrary, it often causes stomatitis and gastro-enteric disturbance. In these cases the symptoms are possibly largely, if not chiefly, due to the secondary degenerative changes in the bone marrow and in the mucous membrane of the digestive tract. Such would seem to be true in Dr. P.'s case, at all events. In the first illness, which was acute, arsenic was well borne and the recovery was rapid, not necessarily because of the arsenic; in the second illness, even small doses of arsenic could not be given without causing stomatitis and epigastric distress. As an evidence of the beneficial effect of arsenic, it is said that those to whom it is given show a larger proportion of remissions than those do who are not so treated. But then these latter cases are usually those who cannot bear it, and include the majority of the worst cases, so that a comparison is misleading.

Many other plans of treatment have been recommended. Red bone marrow is used by Sir Thomas Fraser, and in some cases good results have followed its administration. Various sera have been used subcutaneously, also physiological salt solution. Antiseptics have been given, especially in cases with vomiting and diarrhoea; of these, probably the best are bismuth salicylate and bismuth naphtholate. These have proved useful in controlling diarrhoea. Gastric lavage in suitable cases has no doubt been of benefit, as has also colon flushing. These means of treatment are useful in some cases, but none of them have more than a limited application. In a disease subject to such marked and sudden changes, either for better or worse, it is difficult to estimate the value of any course of treatment.

The outlook in any case is not necessarily unfavorable for the immediate future, even though the condition may be marked by great prostration. The more prolonged and continuous the patient has been on the "down grade," the more unfavorable is apparently the outlook. However, in most cases temporary improvement is the rule. In the large majority of cases reported, few have lived beyond three or four years from the onset. We cannot hope to be much more successful in our treatment until we have discovered the actual cause of the disease.

⁴ British Medical Journal, 1908, ii.

DIAGNOSTIC PUNCTURE IN TUBERCULOUS ABSCESSSES.

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THE profession has become familiar with puncture of the peritoneal, pleural, and pericardial cavities, with lumbar puncture, exploratory aspiration of the liver, of certain cysts and collections of localized pus, but puncture of tuberculous abscess for diagnostic verification as a routine procedure has been neglected.

From the earliest periods of medical knowledge down to the present time physicians have hesitated to evacuate cold abscesses—so-called—because of doubt as to the character of their contents. The too frequent production of mixed infection meant prolonged sepsis with all its serious complications and frequent death. If by diagnostic puncture one can ascertain to a certainty the bacteriological composition of the contents, the necessity for incision and drainage or the opposite can be definitely determined. The following paper is founded upon a personal experience which has proved the great value of diagnostic puncture in this class of cases.

The diagnostic puncture should be made with an exploring syringe veterinary syringe, or lumbar puncture syringe, or with an ordinary hypodermic syringe, since the object is not to withdraw a large quantity of fluid for therapeutic purposes, but only sufficient for laboratory examinations. The puncture should be performed under the most strict antiseptic precautions, both in regard to the preparation of the part to be punctured and the instrument employed and the hands of the surgeon. The part must be thoroughly scrubbed with green soap and sterile water, with bichloride solution, with alcohol, and finally with ether or turpentine. The hands of the surgeon should be thoroughly scrubbed with green soap and sterile water and soaked in alcohol and a bichloride solution. The syringe and needles should be thoroughly boiled for twenty minutes and kept in alcohol until used. The syringe which I use is the small glass one made for hypodermic purposes. The puncture should not be made in the most prominent or thinnest part of the collection, but through sound skin, care being taken to avoid large veins and important structures.

The pain caused by the puncture may be diminished by local anesthesia with ethyl chloride, cocaine being seldom necessary and ice and salt not being sterile. A portion of the fluid withdrawn in the syringe should be placed in a sterile test-tube prepared for the purpose of the subsequent laboratory examinations, and the remaining should be dropped upon one or more prepared slides for immediate clinical microscopic examinations. The puncture should be sealed

with sterile cotton or gauze and collodion. If the fluid cannot be withdrawn through so fine a needle, the larger exploring syringe or the Potain or other vacuum aspirator should be employed.

The exploratory puncture for diagnostic purposes should be made several days before any contemplated operation in order to use the laboratory findings in the surgical treatment of the abscess or of the primary pathological lesion. In slowly forming exudates of questionable character advantage may be taken of this delay to determine by inoculation their exact pathological character.

EXAMINATION OF THE FLUID. More important than the determination of the physical character of the fluid, the color, coagulability, odor, and transparency, is the information obtained by the microscopic examination and the culture findings. The examination should also include the cell counting, of the same character as the cytodiagnosis employed in pleural effusion. If there is a marked increase in the lymphocytes, over 50 per cent. of this should be in favor of tuberculosis, since the predominance of polymorphonuclear cells would indicate a non-tuberculous origin.

If the fluid withdrawn is sanguinolent, a careful comparison with the blood of the individual, taken at the same time will be of great value, as shown in Case II.

The presence or absence of bacteria in large quantities, such as tubercle bacilli, staphylococci, streptococci, and actinomycosis can readily be determined by this most simple microscopic examination, but the advantages of waiting for the laboratory reports are the more accurate conclusions which may be deduced by taking into consideration the physical characteristics together with the microscopic and culture findings.

If the smear slides are not satisfactory, and the culture findings are negative for tuberculosis, inoculation of guinea-pigs should be made in suitable cases. In all doubtful cases this has invariably been the my practice. These reports are, however, received so late that they are confirmatory rather than of any practical value in operative treatment.

The examination of fluid taken from 25 operative cases several days before operation by myself, all of which were diseases of the joints and some of which required excisions of the major joints, 3 being excision of the hip joints, showed 6 to contain tubercle bacilli, 6 to contain pyogenic organisms, and 12 were sterile. Among the organisms found were streptococci, staphylococci, *Bacillus pyocyaneus*, and pneumococci. Of the sterile abscesses, inoculation into guinea-pigs showed that 2 were negative and 1 positive for tuberculosis.

The examination of the fluid is not only valuable in determining the character of the disease, but is also important in deciding what operative measures shall be adopted. The treatment of the abscesses themselves will vary according to the findings, and in the cases

described by me in a previous paper,¹ three different groups were made according as the aspirated fluid was sterile or contained tubercle, or had mixed infection. The examination of the fluid enables the operator to decide whether an operation is immediately required, as well as the character of the operation demanded.

The following cases illustrate the value of diagnostic puncture in tuberculous abscesses:

CASE I.—R. F., a white boy, aged four years, came under my care November 26, 1906, having suffered from left knee-joint disease since June, 1905. The family history was negative, except that one paternal aunt died of hip tuberculosis. The joints presented the characteristic symptoms of tuberculous disease, being enlarged, pale, with prominent veins, the knee fixed at an angle of 15 degrees. Upon the anterior aspect of the thigh, about 6 inches above the patella, was a large abscess. The *x*-ray examination of the knee-joint showed partial destruction of the epiphysis of the femur, with thickened synovial membrane and no fluid within the joint; the diagnostic puncture showed the fluid to be sterile, and inoculation of guinea-pigs with this fluid was negative for tuberculosis.

The abscess was incised, thoroughly curetted, and closed without drainage, a firm compress was applied, and the limb was fixed in a plaster-of-Paris cast. Recovery was prompt and permanent, and there has been no return of the disease. Without diagnostic puncture the patient would have had his abscess incised and curetted and had drainage inserted for many days, with possible infection of the part.

CASE II.—J. O., aged eight years, was admitted to the Polyclinic Hospital, April 19, 1906. His parents were living and there was no tuberculous history in the family. The child had had the usual exanthemas of youth, and when five years of age he injured his right hip by falling while roller skating. After a month's treatment at home he was admitted to the hospital under my care, for flexion of the hip-joint. This was overcome and the adhesions broken up by manipulation and tenotomy of the right sartorius at its origin. In August, 1906, he received another injury by a kick on the hip, which renewed the inflammation in the hip-joint. Upon his admission in November there was some induration and swelling of the hip-joint, with enlarged inguinal glands; there was some limitation of motion, and he walked with a limp. The *x*-ray examination at this time showed changes in the cartilage of the head of the femur; his physical examination was otherwise negative. His pain increased and became excruciating, notwithstanding the use of a Buck's extension and a lateral weight applied to the upper part of the femur. On December 13, under ether narcosis, I aspirated the hip-joint and removed two drains of bloody fluid, which

¹ Amer. Jour. Orthop. Surg., 1907.

contained bone marrow, and which showed a rupture of the abscess from the medullary structure into the cavity of the joint.

The report of the laboratory findings of this diagnostic puncture by Dr. John M. Swan, of the Polyclinic Hospital, is of great value, and compared with the examination of his blood taken at the same time verified the opinion that the fluid had ruptured from the bone into the joint cavity at this time. These examinations are given side by side for comparison. The bacteriological examination of the fluid was negative for tuberculosis. The diagnostic puncture entirely relieved the pain, and he subsequently made a satisfactory recovery under mechanical treatment.

Blood Count, December 17, 1906.

Differential count:

	Per cent.
Polymorph. nucleated . . .	52.0
Lymphocytes	18.0
Transitional	17.4
Eosinophiles	9.8
Basophiles	1.2
Myelocytes	1.6
	<hr/>
	100.0

Specimen of fluid aspirated gave the following; about pure blood with large white cells:

Differential count:

	Per cent.
Polymorph. nucleated . . .	36.4
Lymphocytes	32.0
Transitional	7.2
Eosinophiles	3.4
Basophiles	0.4
Myelocytes	18.6
Eosinophiles and Myelocytes	2.0
	<hr/>
	100.0

Without the information obtained by diagnostic puncture this patient would possibly have been subjected to incision or excision of the hip-joint with prolonged drainage and the possibility of mixed infection.

CASE III.—W. G., male, aged sixteen years, came under my care January 20, 1907, suffering from tuberculosis of the left knee-joint. Five years before he had been operated on for congenital double dislocation of the hips; the left one was perfectly reduced and the other one partially reduced, the tuberculous knee for which he presented himself being in the perfectly reduced side. The examination of the diagnostic fluid showed the presence of a few streptococci and a large number of staphylococci. The joint was opened by incision through the skin on the inner side, and the division of the synovial sac by the Paquelin cautery and counter-incision in the same manner on the outer side, with thorough irrigation with a 5 per cent. of formalin solution and drainage. He made a prompt recovery. The diagnostic puncture here enabled me to drain thoroughly and promptly the knee-joint.

PRIMARY TUMOR OF THE VELUM, WITH MARKED COMPRESSION OF THE FOURTH VENTRICLE.

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THE patient was a girl, aged eleven years. She first came under the observation of Dr. J. Constantine MacGuire, to whom I am indebted for the history and most of the clinical notes of the case. The child was born of nervous and excitable parents, and from early life had been the witness of constant domestic disturbances, so that the nervous condition that she presented had been looked upon as fully accounted for. She had suffered from various diseases of infancy, and had always been considered frail, although of about normal size and development for her age. Previous to coming under the care of Dr. MacGuire she had been ill for two weeks, suffering from a condition diagnosed as "brain fever."

On examination she showed general muscular rigidity of a spasmodic character, with slight opisthotonos. She rolled and tossed about the bed, was illogical, and had at times to be restrained. Occasionally she screamed and cried hysterically. She complained rather persistently of pains in the head. The knee-jerks were accentuated, there were no ocular disturbances manifest, and examination of the eye grounds was said to be negative. There was no Babinski reflex, no elevation of the temperature, and the pulse varied from rapid to slow. At this time a diagnosis of probable meningitis was made.

The child was removed from her surroundings, which were manifestly bad for her condition, and was placed under observation in a hospital. Here she was actively purged and put upon vigorous doses of the bromides. Under this treatment the symptoms apparently entirely cleared up, the muscular rigidity passed away, and the child was soon able to sit up and to walk about the ward. Mentally, the condition became apparently normal, cerebration and speech were quick and apparently natural in every way and the patient became cheerful and uncomplaining. Medical treatment was then entirely suspended, but the child remained under observation. With this startling result following treatment, naturally a diagnosis of hysteria was made.

Some days after apparent recovery a parent of the child was permitted to see her and, unknown to the attending physician, brought a detective, who sharply questioned the child as to alleged misdoings on the part of the other parent. The girl became very much distressed and excited, and shortly after this ordeal developed convulsive attacks of the same nature as those previously present, during which she soon died.

Postmortem examination shortly after death showed a practically normal condition throughout the entire body, except for the following lesions in the brain, which are quoted verbatim from the protocol: "The skull, scalp, and dura mater are entirely normal, but the blood-vessels of the pia-arachnoid are moderately injected. The markings of the brain are regular, symmetrical, and typical. The convolutions are, however, remarkably flattened, and palpation of the hemispheres shows fluctuation. On removal of the brain from the skull the infundibulum is found to be greatly distended, and, on its rupture, about 500 c.c. of clear cerebrospinal fluid escapes. The sella turcica is somewhat excavated, as a result of the infundibular distention, but the pituitary body is apparently normal. The optic chiasm is compressed by the bulging infundibulum and its bands are thinned and slightly atrophied. The foramen of Munro is greatly dilated, and on opening the lateral ventricles, they were found to be enormously distended from cerebrospinal fluid. The choroid plexuses are anemic, but otherwise apparently normal. Section through the cortical tissue of the cerebrum shows marked anemia, but otherwise, aside from compression, it is apparently normal. The cortical gray matter is normally thick and regular. Section of the pons, medulla, and cerebellum shows a large tumor mass, apparently originating from the velum, which covers in the floor of the fourth ventricle. As a result the floor of the ventricle and the superjacent substance of the cerebellum are greatly compressed, but neither tissue appears to be integrally invaded.

"On careful dissection the tumor can be readily separated from the cerebellum, but not from the floor of the fourth ventricle, where it is firmly attached by a more or less clearly defined adhesive pedicle, which covers it in almost the entire ventricular area. The tumor is flattened, oval in form, it measures 6 cm. in diameter, and 3 cm. from above downward. It is light pink in color, very soft, and almost pultaceous in consistence, but it shows no areas of gross necrosis. The superjacent cerebellum is very much compressed, but no areas of invasion or of degeneration can be made out in it. No strands of degeneration are grossly demonstrable in the tracts of the lower medulla or in the cervical cord, although the ventricle of this portion of the cord is somewhat dilated. The tumor has completely obliterated by compression the iter and the passage below connecting the medullary ventricle with that of the cord; this is doubtless the explanation of the condition of hydrocephalus."

"Microscopic examination of the tumor shows it to be composed of a diffuse mass of embryonic connective tissue cells, which are for the greater part of the small round-cell type. The stroma is very scanty and is largely composed of spindle-shaped cells which are evidently closely related to those which make up the chief mass of the tumor. Bloodvessels are infrequent, but the tumor is rich in what are apparently lymph passages. The smaller channels are

composed of irregularly arranged tumor cells, and only the larger vessels show a definite structure, into which adult connective tissue and endothelium enter. Portions of the velum remain still intact in the growth, though the neoplasm has evidently sprung from the connective tissues of this structure. No direct evidence of invasion of the tissue of the cerebellum or medulla can be made out."

Histologically, I am inclined to class this tumor as a sarcoma of the small round-cell variety, but in some respects it resembles a glioma. Taking into consideration, however, its evident point of origin, I believe that I am fully justified in the assumption that the growth is a sarcoma.

From a clinical standpoint the case is chiefly interesting and remarkable in that with so marked a growth complete relief of symptoms took place from time to time. It is, of course, absurd to assume that the bromide had directly to do with this amelioration, but I am rather inclined to the idea that the cartharsis, with the mental quiet and rest which the child enjoyed after removal from her home were partly responsible for the cessation of symptoms. It is, however, possible that the inhibiting action of the bromide on the activity of the ganglion cells really may have had an effect in assisting this improvement.

Manifestly, the convulsive and irritative symptoms shown by the patient when she was first seen were due to the acute hydrocephalus. It is probable that with the rest in bed and quiet of the hospital a certain amount of absorption of this fluid, with relief of the cortical pressure, took place, as a result of which the temporary improvement noted occurred. It also seems probable that the excitement induced by the painful questioning of the sensitive child caused a cerebral hyperemia, with, perhaps, increased secretion of cerebrospinal fluid, increased cortical tension, and resulting convulsions and death.

It is extremely difficult to understand why choked disk, Babinski reflex, and other evidences of cerebral compression were absent in this case. The absence of disturbances of equilibrium with so marked cerebellar compression is truly remarkable, but no more so than the absence of respiratory and cardiac disturbances when the floor of the fourth ventricle was so universally and remarkably compressed.

In so far as I have been able to determine, the case is unique, not only in symptomatology, but also in the location and character of the tumor. As a whole, it only verifies the quaint statement said to have been made by Charcot, that "there is no lesion of the central nervous system which may not exist at times without symptoms, and there are no symptoms which may not appear without lesion."

REVIEWS.

A PRACTICAL TREATISE ON FRACTURES AND DISLOCATIONS. By LEWIS A. STIMSON, M.D., Professor of Surgery in the Cornell University Medical College. Sixth edition; pp. 876; 361 illustrations and 65 monotint plates. New York and Philadelphia: Lea & Febiger, 1910.

A NEW edition of this surgical classic is of interest chiefly in relation to the additions or changes that have been made since the last one (1907). The author states that they relate largely to carpal and tarsal injuries, to midcarpal fracture-dislocations, to fractures of the acetabular floor and of the femoral internal epicondyle, and to backward dislocation of the mandible. He might have added habitual dislocation of the shoulder, as after referring (p. 620) to T. T. Thomas' excellent paper on that subject (see AMERICAN JOURNAL OF THE MEDICAL SCIENCES, February and March, 1909) he recurs to it (p. 624) and says that "in an unknown proportion of cases" Thomas' operation is an ideal one. It consists essentially in exposing the capsule through an axillary incision between the coracobrachialis and the nerves and vessels, dividing the tendon of the subscapularis, excising the new tissue, filling in the gap in the capsule, and suturing the sides of the rent to each other. He questions the advisability of dividing the subscapular tendon, but as he has himself had two satisfactory results in cases not especially adapted for the operation, as it has uniformly given similar results in the hands of its originator and of other operators, and as it removes the predisposing pathological condition, closes the capsular tear and permits of thorough inspection of the interior of the joint, the adjective—"ideal"—would seem not to be misapplied.

The amplified and considerably changed section on the fractures of the carpus embodies the results obtained by Ebermayer, Delbet, and others, and sets forth the now well established frequency of fracture of the scaphoid, which is described as an "alternative lesion" to Colles' fracture, the radius breaking more often in the old, whose epiphyses are thinner and in whom the expanded articular extremity of the bone is brittle and weakened. The characteristic clinical symptom is sharp pain on pressure in the *tabatière anatomique*, but an *x-ray* examination is often essential and always desirable.

The prognosis is somewhat unfavorable on account of the probability of limitation of flexion and extension of the wrist.

The author recommends in fresh simple cases without displacement immobilization for a month, and adds that the records show better results than those obtained by passive motion and mechanico-therapy. This seems too absolute. It is difficult to believe that *judicious* massage and passive motion would not here, as elsewhere, favor both rapid union and freedom from functional disability. When there is distinct displacement of the proximal fragment it should be removed.

Associated with this subject are the "midcarpal fracture-dislocations" in which, usually as a consequence of a fall upon the ball of the over-extended ("dorsally flexed") hand there are in addition to the fracture of the scaphoid, displacement of the semilunar and the upper fragment of the scaphoid, and subluxation of the os magnum. The new subsection on this rather rare injury summarizes the observations of Schoch and Delbet.

The symptoms are flexion of the fingers with pain on an attempt at straightening them; shortening and thickening of the wrist; slight shifting of the hand to the radial side with prominence of the ulnar end. The diagnosis must be made from sprain, Colles' fracture and fractures of the scaphoid. The author says: "if" the *x*-rays are used lateral and antero-posterior views should be taken. It would be better to advise that in every case in which this midcarpal lesion is even suspected good *x*-ray plates be obtained as an indispensable aid to accurate diagnosis. Simple reduction, operative reduction, and excision of one or more bones, represent the possible methods of treatment.

The rare injuries of radiating fracture of the acetabulum, fracture of the floor of the acetabulum, and backward dislocation of the lower jaw, are briefly but sufficiently described, the former in a new subsection, the latter in a paragraph.

The book remains, as always, the most complete, conscientious, and satisfactory treatise on fractures and dislocations that has yet been written. For the teacher or for the experienced practitioner it leaves nothing to be desired. For the student a "synopsis" dealing almost exclusively with symptomatology, diagnosis, prognosis and treatment, could not fail to be useful. We have often thought that the author would do well to have such a compendium prepared, and believe it would meet a genuine want in American surgical literature.

Here and there throughout the book we miss mention of methods and appliances that have come into vogue of late years, but it is fair to say that in our opinion their absence does not detract from the practical usefulness of the work, and that, doubtless, is also the opinion of the author.

J. W. W.

DISEASES OF INFANTS AND CHILDREN. By HENRY DWIGHT CHAPIN, A.M., M.D., Professor of Diseases of Children in the New York Post-Graduate Medical School and Hospital; and GODFREY ROGER PISEK, M.D., Professor of Diseases of Children in the University of Vermont; Adjunct Professor of Diseases of Children in the New York Post-Graduate Medical School and Hospital. Pp. 609; 179 illustrations, and 11 colored plates. New York: William Wood & Co., 1909.

IN order to offer intelligent criticism of a book it is essential not to lose sight of the purpose for which it was written. The authors of the present volume state in the preface that their object has been to contribute a book which should stand midway between a mere compendium and an exhaustive treatise on pediatrics. It would, therefore, be unfair to judge this book in comparison with some of the more elaborate works on diseases of children. However, from the standpoint of a text-book well adapted to the needs of the medical student it must be conceded that the authors have successfully accomplished their purpose.

One is impressed by the wide scope of the work: not only are the usual medical conditions dealt with, but the commoner surgical diseases of children, as well as those of the skin and organs of special sense, are also taken up. As a result of such multiplicity many of the descriptions are of necessity almost too brief. This conciseness is especially noticeable in the pathological descriptions, which are frequently inadequate or entirely wanting. The chief stress is laid upon symptomatology and diagnosis. That the book is thoroughly up-to-date is evidenced by the fact that procedures of such recent development as the various tuberculin reactions, the Wasserman reaction, opsonins, and vaccine therapy are fully described in the chapters on clinical examination and therapeutics. It is also gratifying to note that wherever treatment is discussed drugs are accorded their proper subordinate position, and emphasis is laid upon the vastly more important role of suitable hygienic and dietetic measures in the management of disease in children.

The feeding of infants is taken up in great detail. Instead, however, of plunging the student into the intricacies of this subject, the more rational plan is followed of first pointing out the anatomical and physiological peculiarities of the infantile digestive organs and then explaining the fundamental biological principles upon which rests the science of infant feeding. Of the various means of adapting cow's milk the authors look with most favor upon the so-called top-milk method, which, because of its simplicity, accuracy, and economy, is gaining in popularity among pediatricists.

No other group of diseases is taken up so fully as are the acute infections. The section on the acute exanthemas is worthy of note; the eruptions are described with unusual clearness, especial

care and attention being given to their differential diagnosis. Although acute anterior poliomyelitis is, with good reason, classified as one of the acute infections, rather than as a nervous disease; curiously enough, pneumonia, preëminently an acute infection, is found under diseases of the lung. Moreover, there would seem to be little to justify grouping the chronic arthritides, as the authors have done, among the acute infectious diseases. Their classification of chronic arthritis is unsatisfactory. For example, under the vague term "rheumatoids" they have included villous arthritis, arthritis deformans, tuberculous arthritis, and Still's disease. In view of the present state of our knowledge, they have, perhaps with wisdom, chosen to ignore the perplexing question of the etiology of the first two forms.

Although for the most part diseases of the heart are adequately covered, such characteristic signs as the pulse of mitral disease and the tapping apex beat and ringing valvular first sound found in mitral stenosis are surely of sufficient importance to deserve mention. Noteworthy omissions also occur under pericarditis. In describing pericarditis with effusion no mention is made of the shapes assumed by the dulness of a pericardial effusion, of Bamberger's posterior patch of dulness, or of the obliteration of the normal cardio-hepatic angle. Furthermore, although of undoubted clinical importance and not infrequent occurrence, chronic adhesive pericarditis is entirely ignored.

The book is well printed, the illustrations are instructive, and there is a pleasing absence of typographical errors. Although the condensed and at times elementary style of the book may impair its value to the trained pediatricist, among students as well as among general practitioners it should enjoy deservedly a wide field of usefulness.

G. M. P.

THE PRACTICE OF MEDICINE. By JAMES TYSON, M.D., Professor of Medicine in the University of Pennsylvania, Philadelphia. Fifth edition; pp. 1438; 250 illustrations. Philadelphia: P. Blakiston's Son & Co., 1909.

In the new recently issued edition of his *Practice of Medicine*, Dr. Tyson presents a careful and thorough revision of his well-known book. Much new matter has been incorporated; the sections on the infectious diseases, diseases of the blood, and diseases of the gastro-intestinal tract especially have been enlarged and improved. Reference has been made to the use of tuberculin in the treatment of tuberculosis; to tests for occult blood in the gastric contents and the feces; to the Cammidge reaction in diseases of the pancreas; to the opsonic index; and to the clinical uses of blood

cultures. The section on tetany and exophthalmic goitre has been largely rewritten, and to these Dr. Beebe has contributed a note on the use of his serum in Graves' disease. There are many other additions and minor alterations throughout the book, all of which, together with the retention of the excellent clinical descriptions and the suggestions for treatment of the previous editions, make the book deservedly one of the most popular of its kind. A. K.

THE MEDICAL COMPLICATIONS, ACCIDENTS, AND SEQUELS OF TYPHOID FEVER AND THE OTHER EXANTHEMAS. By HOBART AMORY HARE, M.D., B.Sc., Professor of Therapeutics in the Jefferson Medical College; and E. J. G. BEARDSLEY, M.D., L.R.C.P. (Lond.), Assistant Demonstrator of Physical Diagnosis and Clinical Medicine in the Jefferson Medical College. With a Special Chapter on the Mental Disturbances Following Typhoid Fever, by FRANCIS X. DERCUM, M.D., Professor of Mental and Nervous Diseases in the Jefferson Medical College, Philadelphia. Second edition; pp. 406; 28 illustrations. Philadelphia and New York: Lea & Febiger, 1909.

THIS volume is in part a revision and amplification of a volume on typhoid fever, issued about ten years ago; in part, also, it comprises a review of recently acquired knowledge of other exanthemas—variola, scarlatina, measles, varicella, and rubella. Three hundred pages are devoted to typhoid fever—to certain general considerations of the disease; to varieties of onset of the infection; to aberrant symptoms, states, or complications of the well-developed stage of the disease; to the complications of the period of convalescence; to conditions which resemble typhoid fever; to the duration of the disease; to immunity to second attacks; and to the mental complications. The literature has been exhaustively reviewed and the compilation is up-to-date; there is little, if anything, about the disease that has not received adequate mention and discussion, except treatment. Were the reviewer hypercritical, he would express regret that treatment also is not mentioned, but he is appreciative of the excellence of the presentation as it is. The chapters on variola, scarlatina, measles, varicella, and rubella are also good, although not so exhaustive as those devoted to typhoid fever. The book undoubtedly is a valuable monograph, and, dealing largely with typhoid fever, a disease widespread in its distribution, protean in its manifestation, and extremely variable in its complications and sequels, should be possessed and read by all physicians who have occasion to treat typhoid fever subjects. A. K.

THE RÖNTGEN RAYS IN PEDIATRICS. The Diagnosis of Diseases in Early Life by the Röntgen Method. By THOMAS MORGAN ROTCH, M.D., Professor of Pediatrics in Harvard University. Pp. 225; 303 illustrations. Philadelphia and London: J. B. Lippincott Company, 1910.

ONE of the essential objects of the author in compiling this treatise is to show in a convincing manner when and how the x -ray examination should be employed in connection with the diagnosis of those diseases, injuries, or abnormal conditions of developmental origin during early life in which method is applicable, and to emphasize the necessity of its employment as a means of completing or confirming clinical data otherwise obtained, in order that the most accurate diagnostic results may be derived. The author is one of the first among American clinicians to take the initial step in dealing with Röntgen diagnosis in a comprehensive manner from the purely clinical standpoint, and aside from any favorable or critical comment that might be made concerning his work as a book, his efforts in this one direction are most commendable. The book is essentially a treatise upon x -ray diagnosis, and does not touch upon apparatus, methods, or technique, except occasionally where some reference to this aspect of radiography may be imperative. As such it will no doubt be regarded in a different light by certain general groups among the medical profession. Taking as one group the undergraduates and the recent graduates, the author states that it is one of his main objects to reach this class in particular and to teach them the full importance of radiography, the extent of its useful application, and how it should be applied as an additional diagnostic method. To this group the book will likely appeal the most strongly and be of the most practical service. It is likely to appeal also, but in a somewhat different manner, to the young and rather inexperienced x -ray man, who may be able to find in it a substitute for some of the experience which he lacks. To the older physician or surgeon and to the Röntgenologist the book has little new information to offer, and can hardly be regarded by them as more than a useful book of reference.

The general arrangement of the subjects and of the text and illustrations is well adapted to the purpose of teaching the correct application of Röntgen diagnosis. In connection with each condition discussed, after a review of its characteristic clinical and pathological features, there follows a discussion of the radiographic features that are likely to be presented, how they are to be recognized, and how to interpret the appearances correctly. Each condition is suitably illustrated by typical radiographic examples which are direct reproductions from skiagrams.

A rather unique feature of the book is the discussion of an additional use for radiography during early life. The author suggests

a plan for utilizing the radiogram as a means of calculating anatomical and physiological development in connection with child labor problems and the grading of gymnastic and atheletic exercise and even education.

H. K. P.

FUNCTIONAL DIAGNOSIS. By THOMAS G. ATKINSON, M.D., Associate Professor of Neurology and Physiology in the Chicago College of Medicine and Surgery, Chicago. Pp. 213. Chicago: Chicago Medical Book Co., 1909.

It may well be questioned if the title of the book under review is not a misnomer, since one would be led to believe, as was the reviewer, that methods of determining altered function were under discussion. What the author has intended to do, however, is to correlate the symptoms and the anatomical lesions producing them in such a way that the diagnostician may be able "to reason back his symptoms to their functional premises, and to state his pathological condition in terms of physiology." Or, to express the thought in another way, the author "attempts the task of translating the normal functions of the body, through their various derangements, into terms of disease." The size of the book precludes any detail, and hence it is that such a statement, as "when any pulmonary disease is accompanied by pain on respiration it is due to an attendant bronchitis or pleurisy," creeps in. Taken all in all, the book seems more fitting to the undergraduate than for the use of the advanced diagnostician, since the latter would be scarcely content to accept some of the author's statements sine deliberatione. E. H. G.

OPHTHALMIC SURGERY: A TREATISE ON SURGICAL OPERATIONS PERTAINING TO THE EYE AND ITS APPENDAGES, WITH CHAPTERS ON PARA-OPERATIVE TECHNIQUE AND THE MANAGEMENT OF INSTRUMENTS. By CHARLES H. BEARD, M.D., Surgeon to the Illinois Charitable Eye and Ear Infirmary. Pp. 674; 309 illustrations. Philadelphia: P. Blakiston's Son & Co., 1910.

THIS work is a description of the various operations practised in the treatment of the surgical diseases of the different structures of the organ of vision and its adnexæ. It includes an account of the instruments employed, the preparation of the patient, and naturally embraces the methods of asepsis and antisepsis as regards instruments and field of operation. The author generally gives expression to his personal views and preferences when a number

of procedures to accomplish the same end are under discussion. These views are in the main judicious, even if somewhat dogmatically expressed. Few would probably dissent from the statement that the time has not yet arrived for the general employment of the Indian method of extraction in the capsule. A valuable part of the work is an account of the principal accidents the operator is liable to meet with and the best methods of preventing their occurrence and remedying their ill effects when they have occurred. The illustrations as a whole are very helpful in elucidating the text; the author somewhat apologetically states that they are "the fruits of his individual labor;" no apology is necessary, but he is to be congratulated upon his skill. Facility in this direction should be cultivated by every one ambitious to succeed in the delicate operations required in ophthalmic surgery as a training to the eye and hand. The work is smaller than Czermak's *Augenärztlichenoperationen*, and about twice as extensive as that of Grimsdale and Brewerton upon the same subject.

While we can say of this work, "It's all there and it's all true" (in the main), we confess to some slight feeling of disappointment; to describe a series of acts is one thing, but to give them that degree of clearness that the reader, as it were, seems to *see* what the writer wishes to convey is another thing; in this respect the work leaves something to be desired. Among other peculiarities of style we observe a frequent use of the expression to "make an operation," instead of to perform or do one—grammatically correct enough, but in the reviewer's opinion a halting form. All these, however, are minor faults, like specks upon the columns of the temple. The author and American ophthalmology are both to be congratulated upon the production and possession of this treatise upon the important subject of ophthalmic surgery.

T. B. S.

STUDIES IN RABIES. Collected Writings of NATHANIEL GARLAND KEIRLE, A.M., M.D., D.Sc., Professor of Medical Jurisprudence and Emeritus Professor of Pathology in the College of Physicians and Surgeons; Director of the Pasteur Institute, Baltimore. With an introduction by WILLIAM H. WELCH, and a Biographical Sketch by HARRY FRIEDENWALD. Testimonial edition. Lord Baltimore Press, Baltimore, Md., 1909.

As a mark of esteem and admiration for Dr. Keirle these studies have been collected and published by his friends. The fourteen papers printed in this volume represent, besides contributions to various medical journals and to the *Twentieth Century Practice of Medicine*, dating from 1893 to the present day, several articles hitherto unpublished; and it is interesting to note in all these papers

the gradual development of our knowledge of rabies and the accumulation of those valuable statistics, which place the present method of treatment upon such a firm foundation. Dr. Keirle's work has been principally directed toward the practical side of the problem, and for this reason the papers upon "The Technique of the Pasteur Antirabic Treatment," "The Fallacy of the Rapid Diagnosis of Rabies, etc.," the statistical articles, and the practical notes on the treatment of those bitten by supposedly rabid animals will have a wide appeal. Perhaps the most valuable chapter in many respects are the two extensive discussions upon rabies, which comprise the major portion of the volume. In these papers Dr. Keirle's experience and careful observations are always apparent. The book cannot fail to be of use to one who wishes to familiarize himself with this important subject.

W. T. L.

HANDBOOK OF DISEASES OF THE EAR FOR THE USE OF STUDENTS AND PRACTITIONERS. By RICHARD LAKE, F.R.C.S., Eng. Surgeon for Diseases of the Ear, etc., in the London School of Clinical Medicine. Third edition; pp. 248; 70 illustrations. New York: William Wood & Co., 1910.

THE third edition of this excellent little handbook will maintain the reputation of its predecessors, as a clear and concise exposition of the first principles of the practice of otology. The book should be of especial value to post-graduate students, or to general practitioners who desire to understand the treatment of the commoner pathological conditions of the ear. Its essential characteristic is its practicality. The author avoids the discussion of disputed points, and confines himself strictly to an exposition of the better known phases of the subject.

F. R. P.

PATHOLOGISCHE ANATOMIE. Edited by L. ASCHOFF, M.D., of Freiburg, i. Br., Germany. Vol. i, pp. 636; 364 illustrations; vol. ii, pp. 815, 552 illustrations. Jena: Gustav Fischer, 1909.

The *Textbook of Pathological Anatomy* edited by Professor Aschoff is the composite work of a number of well known German teachers. In the first volume, E. Albrecht, of Frankfurt, discusses the internal causes of disease; M. Askanazy, of Geneva, the external causes of diseases; E. Schwalbe, of Rostock, malformations; E. Giercke, of Karlsruhe, disorders of metabolism and of internal secretion; A. Dietrich, of Charlottenburg, disturbances of circulation; R. Kretz, of Prague, immunity; O. Lubarsch, of Düsseldorf, in-

flammation; and M. Borst, of Wurzburg, organization, regeneration and tumor formation. In the second volume the editor discusses diseases of the heart and pericardium, of the urinary apparatus, and of the female genitalia; C. Benda, of Berlin, diseases of the bloodvessels; H. Schridde, of Freiburg, diseases of the blood-forming organs and the thymus; O. Naegeli, of Zürich, diseases of the blood; M. B. Schmidt, of Zürich, diseases of the locomotive apparatus; H. Beitzke, of Berlin, diseases of the respiratory organs; B. Fischer, of Frankfurt, diseases of the digestive organs; C. Sternberg, of Brünn, diseases of the liver and the biliary passages; M. Simmonds, of Hamburg, diseases of the male genitalia; O. Ernst, of Heidelberg, diseases of the nervous system; and L. Jores, of Cologne, diseases of the skin. The work is a valuable addition to contemporary medical literature splendidly illustrated, and since it is representative of the present German school of pathology it may be much commended.

A. K.

GENETIC PSYCHOLOGY. By EDWIN A. KIRKPATRICK, B.S., M.PH.
Pp. 373. Macmillan: New York, 1909.

IN this work the author has attempted to correlate all life phenomena, from those of plant growth to the most complex processes of consciousness of the human mind, applying the theory of evolution to psychology. "Not until the facts and theories of all the sciences concerned with life phenomena have been studied to determine their common and their differentiating characteristics, can we have a psychology that is a fitting apex to these sciences." Acting upon this principle, the subject is taken up with a consideration of the structural basis of behavior and types of animal behavior, tracing the different reactions in the various organisms from the purely physiological processes in the lowest to the complex behavior characteristic of the higher species of animals and the abstract concepts developed only in the brain of man. Aside from the manner of presentation, which is undoubtedly favorable to a broad conception of the subject, this book does not differ materially from others elemental works on psychology.

S. D. I.

PROGRESS OF MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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The Relation of Typhus Fever to Rocky Mountain Spotted Fever.—
RICKETTS and WILDER (*Arch. Int. Med.*, 1910, v, 361) have made a careful study of the clinical, anatomical, and immunological relationships between Rocky Mountain spotted fever and the typhus fever (tabardillo) of Mexico. In both the condition is that of a systematic blood infection and presumably lymph infection without the critical involvement of particular organs. Clinically the eruptions are very similar, differing but slightly in time of appearance and distribution. Gangrene occurs in both diseases. The spleen is habitually enlarged in spotted fever, not in typhus. The fever in typhus is more abrupt in onset and termination and the course shorter. They have the feature of insect transmission in common, the body louse in the case of typhus and ticks in spotted fever. It is probable that neither disease is contagious. A striking difference, however, is found in the susceptibility of animals to the two diseases. All attempts to infect laboratory animals with the blood of typhus fever patients have failed. Spotted fever can be transmitted to the guinea-pig invariably by the subcutaneous or intraperitoneal injection of virulent blood. This evidence shows definitely that the two diseases are not identical. In addition it was demonstrated that an attack of typhus fever in the monkey does not render him immune to spotted fever, although it does protect him against infection from a second injection of virulent typhus virus. The serum of typhus convalescents exerts no more protective effect against spotted fever than does normal serum. Such serums also show little or no more agglutinating effect for the bacilli which appear to be associated with spotted fever than do normal serums. The authors conclude from this evidence that the diseases are not identical and the organisms are not closely related biologically.

The Pressor Bases of the Urine.—BAIN (*Lancet*, 1910, i, 1190), working in Halliburton's laboratory, found the so-called pressor bases were most readily obtained by shaking the urine with blood charcoal (Fleming's) and extracting with ether and alcohol. The base in the ethereal extract is probably iso-amylamine, a derivative of leucine; that in the alcohol is p-hydroxyphenylethylamine from tyrosine. These extracts, from normal urines, will produce a rise in blood pressure when injected intravenously in cats. The exception is in normal urines from growing children in which they seem to be constantly in minimal amounts. The pathological interest lies in the fact that these pressor bases are very much diminished or entirely absent from the urines of individuals with high blood pressures. Bain feels that they are probably retained in the body and play an important part in the production of the increased blood pressure. Although he locates the source of these substances in the intestinal putrefactive processes, still he was unable to influence their presence by change of diet, lactobacilline milk, or, such intestinal antiseptics as calomel and salol.

The White Line of Adrenal Insufficiency.—In 1904 Sargent described a new sign of adrenal insufficiency due to arterial hypotension. It is the "white line" which results from the ordinary dermatographia test. LAUTIER and GREGOIRE (*Soc. de biol.*, 1910, lxvii, 690) found the white line present in 145 out of 228 cases; 65 of these had hypotension and 80 a normal or hypertension. The 83 cases which did not give the test included 30 with hypotension and 53 with normal or hypertension. The 80 cases with the white line without hypotension and 30 with hypotension without the white line make a total of 110, or one-half of the 228 cases tested which do not conform to the rule. They conclude that the white line cannot therefore constitute a sign of either adrenal insufficiency or hypotension.

Vasophylaxis.—ATKINSON and FITZPATRICK (*Proc. Soc. Exper. Biol. and Med.*, 1910, vii, 77) have found that dogs sensitized by a subcutaneous injection of 5 c.c. of tuberculin suffer a marked reduction in arterial blood pressure when serum from tuberculous rabbits is injected intravenously at an interval of twelve to eighteen hours after the sensitization. The reaction is specific as far as tested. Glanders serum, typhoid, antityphoid, antistreptococcus, normal rabbit, and normal horse sera have all been tested. The reaction is probably one of the many phases of sensitization or increased susceptibility, following the action of toxic substances. The reaction, it is suggested, if found sufficiently specific, may be used as another method for the diagnosis of tuberculosis. The authors tentatively name the phenomenon vasophylaxis.

Further Clinical Observations on the Sphenopalatine Ganglion.—A year ago SLUDER pointed out a symptom complex whose starting point was referred to the sphenopalatine ganglion. Its most frequent neuralgic manifestation is pain beginning at the root of the nose, taking in the upper jaw and sometimes the lower jaw, extending backward under the zygoma and frequently including the ear, marked at the mastoid

but most intense at a point 5 cm. posterior to it. It reaches back over the occiput, descends into the neck, and even into the shoulder blade, shoulder, axilla, arm, forearm, and hand. The pterygomaxillary fossa in which the ganglion lies reacts like an accessory nasal sinus, and the neuralgia has arisen secondarily to inflammatory processes in the nasal sinuses. He has been able to stop the pain by applying cocaine to the nasal mucous membrane at the site of the sphenopalatine foramen, beneath which the ganglion lies. Sluder has further observed certain motor, sensory, and gustatory signs of this affection (*New York Med. Jour.*, 1910, xci, 850). A large proportion of the cases show an asymmetry of the arches of the soft palate with a slight deviation of the median ridge toward the well side. The arch on the affected side is the higher, and the uvula frequently inclines to the well side. The sensation is distinctly dulled on the affected side of the uvula as far forward as its junction with the hard palate. These signs he has observed to appear and disappear with the attacks of neuralgia. Fifty normal cases showed no asymmetry or difference in sensation on the two sides. In ten neuralgic cases tested, the sense of taste was more acute on the well side. It was constantly less acute on the side of the higher arch, or the side from which the median ridge was deflected. This remained slightly diminished after the attacks of pain had subsided.

The Elimination of Bacteria from the Blood through the Wall of the Intestine.—HESS pointed out a year ago that bacteria injected into the blood stream in rabbits could be recovered by culture from the contents of the small intestine. He has continued the work by investigating the path by which these bacteria enter the alimentary tract (*Proc. Soc. Exper. Biol. and Med.*, 1910, vii, 82). He employed *Bacillus prodigiosus* and rabbits in his experiments. Four routes seemed possible: (1) The bacteria may enter the lung and then gain access to the gastro-intestinal tract; (2) they may enter the intestine through the common bile duct or through the (3) pancreatic duct; or (4) they may traverse the wall of the intestine. Ligation of the pylorus, the common bile duct, and of the pancreatic duct had no influence upon the finding of these bacilli in two to three hours after injection into the ear vein. Division of the intestine into segments resulted in showing no difference at all in the permeability of the various segments of the intestinal wall. The bacteria were excreted by the bile and also were found in the urine, but they apparently traversed with ease the walls of the small intestine in a manner which, however, has not yet been demonstrated by Hess.

Experimental Hypophysectomy.—CROWE, CUSHING, and HOMANS (*Johns Hopkins Hosp. Bull.*, 1910, xxi, 127) have continued their reports of the study of the hypophysis and its removal. The total removal results in a state of apituitarism which leads inevitably to the death of the animal. This occurs with a peculiar and characteristic train of symptoms (cachexia hypophyseopriva). The animals become lethargic. The body temperature falls to approximately the room temperature. The gait becomes awkward and unsteady, especially in the hind legs. The blood pressure falls and the pulse becomes feeble, irregular, and slow. Tremors and spasmodic muscular twitch-

ings develop; finally, complete anesthesia, then deep coma ensue, the transition to death being almost imperceptible. That this is not due to surgical trauma is evidenced by the facts (1) that the same operative manipulations leaving the hypophysis in place and omitting the single step of removal leads to no symptoms whatsoever, and (2) that incomplete removals produce no immediate disturbances. These same symptoms follow the removal of the entire anterior lobe alone, even though the posterior lobe remains in place. On the other hand, removal of the posterior lobe leads to none of the manifestations of cachexia hypophyseopriva. Definite constitutional disturbances regarded by the authors as manifestations of hypopituitarism have been observed after partial removals (anterior lobe) in a number of animals kept under observation for long periods of time. The most striking feature is a state of adiposity accompanied by a secondary hypoplasia of the organs of generation in adults or by a persistence of sexual infantilism in case the primary hypophyseal deficiency antedates adolescence. Polyuria, glycosuria, alterations in skin and appendages (such as oedema and hypotrichosis), the tendency to a subnormal body temperature, and psychic disturbances are more or less frequent accompaniments—all of them symptoms which occasionally occur with states of adiposity and of sexual infantilism in man, in company with certain pituitary body tumors—states, therefore, which presumably are due to hypophyseal (anterior lobe) deficiency. Animals, in states of hypopituitarism, appear to have a lowered resistance to infection, exposure, or disease. Boiled anterior lobe emulsions appear to elicit a characteristic (anaphylactic?) febrile response when injected subcutaneously in states of experimental hypopituitarism.

The Function of the Hypophysis.—FRANCHINI (*Berl. klin. Woch.*, 1910, xlvii, 613, 670, 719), as the result of extensive experimental investigations, has reached the following conclusions as to the functions of the hypophysis: (1) Administration of the hypophysis (obtained from the ox and the horse) leads to severe changes in metabolism, especially of the inorganic salts, manifested by a marked deficit in calcium, magnesium, and, to a less degree, phosphorus. (2) The hypophyseal extract produces glycosuria in rabbits only exceptionally. (3) Aside from its toxic action on rabbits and guinea-pigs, hypophyseal extract exerts a special influence on the intestinal canal, leading to ulceration and hemorrhage, probably due in part to vascular change, in part to lesion of the trophic nerves. (4) The extract is most toxic when administered intravenously, less so when given subcutaneously or by mouth; digestion of the extract *in vitro* lessens its toxicity somewhat. (5) The anterior lobe, freed from its epithelial covering, causes only mild symptoms in rabbits, but if the epithelial layer of the posterior lobe be included, death of the animal may ensue. The isolated posterior lobe exerts its effect particularly upon the metabolism and on the vessels and organs of the abdomen. (6) The posterior lobe contains a substance which produces active mydriasis of the frog's eye, but does not give the other adrenalin reactions. This body is absent from the anterior lobe, present in the epithelial layer, but to a less extent than in the posterior lobe. The serum of animals which have received extract of the posterior lobe causes mydriasis; this is seldom the case when anterior lobe extract is used.

The Detection of Levulose in the Urine.—JOLLES (*Münch. med. Woch.*, 1910, lvii, 353) proposes a slight modification of the Ihl-Pachmann reaction for levulose, by which it may be applied to the detection of levulose in the urine. By experiment the author has found that the Ihl-Pachmann test is capable of demonstrating levulose in a dilution of 0.005 per cent. If the urine to be tested contains no dextrose or dextrose up to 2.5 per cent., it is diluted ten times with water (for a 0.25 per cent. solution of dextrose may give a faint positive test for levulose, but only after boiling seventy to ninety seconds). To 1 c.c. of the diluted urine one adds 8 to 10 drops of a 20 per cent. alcoholic solution of diphenylamin and about 1 c.c. of concentrated HCl. The mixture is boiled about sixty seconds. If no levulose is present, the solution remains colorless; if even 0.05 per cent. of levulose is present (in the undiluted urine), a characteristic blue color appears after boiling about forty seconds. Where dextrose amounts to between 2.5 per cent. and 5 per cent. in the urine, the latter must be diluted twenty times before applying the test, which is now capable of revealing the presence of 0.1 per cent. of levulose or more.

The Meistagmin Reaction in Typhoid Fever, Tuberculosis, Echinococcus Disease, and Ankylostomiasis.—IZAR (*Münch. med. Woch.*, 1910, lvii, 842) reports further observations on the diagnostic value of the meistagmin reaction, which tend to show that it is specific and of value in clinical medicine. In 40 cases of pulmonary tuberculosis, in which the diagnosis was confirmed by the cutaneous test or the finding of bacilli, or, in most cases, by both, 39 gave a positive meistagmin reaction. Sera from 74 non-tuberculous patients tested with tuberculous antigen reacted negatively. The tuberculous sera were negative when tested with the antigens of typhoid, lues, tumor (malignant?), ankylostoma and echinococcus. In like manner, the meistagmin reaction was positive in 9 cases of typhoid fever. Sera from 6 patients suffering with ankylostomiasis gave positive reactions only with ankylostoma antigen. A negative reaction obtained with the serum of a patient infected with *Strongyloides stercoralis* when tested against ankylostomum antigen, was striking. Seven cows and three swine having echinococcus cysts showed a positive reaction with echinococcus antigen. These results agree with those recently reported, and make it highly probable that the meistagmin reaction will prove to be of great aid in diagnosis.

The Relation of Diacetic Acid to β -Oxybutyric Acid.—BLUM (*Münch. med. Woch.*, 1910, lvii, 683) reports observations made on man and dogs which are of great interest in connection with acidosis and the metabolism of the fatty acids. In normal dogs he has introduced various substances subcutaneously in large quantities, and in normal men and mild diabetics has given them per os. His studies have resulted in the following conclusions: (1) β -oxybutyric acid may be derived from diacetic acid both in dogs and man. (2) In the metabolism of the fatty acids, such as butyric, caproic, and isovaleric, diacetic acid arises. (3) β -oxybutyric acid is not converted into diacetic acid in the normal animal. (4) The change of β -oxybutyric acid into diacetic acid is probably the result of disease of

the liver cells; the glycogen content of the liver does not explain the change. (5) Crotonic acid, an unsaturated fatty acid, is converted into β -oxybutyric acid by the addition of water. (6) The surviving liver of normal dogs may reduce diacetic acid to β -oxybutyric acid. (7) β -oxybutyric acid is much less toxic than many other fatty acids. This fact makes it difficult to accept the theory (von Noorden, Lepine) that β -oxybutyric acid is the specific poison causing coma diabeticum.

The Etiology of Hodgkin's Disease and Lymphatic Leukemia.—FRÄNKEL and MUCH (*Münch. med. Woch.*, 1910, lvii, 685) have applied the antiformin method to the study of organs, especially glands and spleen, of patients having Hodgkin's disease and lymphatic leukemia. In nine out of ten cases of Hodgkin's disease they have found a granular bacillus which stains by Gram's method, but not by Ziehl's, resembling the tubercle bacillus morphologically and, like it, antiformin-fast. This bacillus was associated with the tubercle bacillus only exceptionally, but it appears to be closely related to the latter. As cultural experiments were negative, a more intimate study of the organism was impossible. Likewise, in seven cases of lymphatic leukemia, the antiformin method revealed a rather thick, granular rod, Gram-positive but Ziehl negative, present in the lymph glands and spleen. They believe these organisms, apparently closely related, will prove to be of etiological significance. Similar studies of tissues of myelogenous leukemia, mediastinal tumor, and carcinomatous glands have shown no organisms.

A Comparative Study of Wassermann Reaction, Lymphocytosis, and Globulin Test in Diseases of the Nervous System.—WOLFF (*Deut. med. Woch.*, 1910, xxxvi, 748) has made a study of the comparative frequency of the Wassermann reaction in the blood and cerebrospinal fluid, and of lymphocytosis and the globulin test in the cerebrospinal fluid, in 100 cases of disease of the nervous system, including 40 cases of tabes dorsalis, 30 of dementia paralytica, 9 of cerebrospinal luca, 5 of apoplexy, 4 of alcoholic neuritis, 6 of neurasthenia, and 6 of epilepsy. He finds that of the three reactions the globulin test gives the most constant results; it is valuable in that it is negative in those cases of syphilis in which no para- or metasyphilitic affections are present. Lymphocytosis and globulin reactions are valuable also in differentiating between organic disease of the central nervous system and peripheral or functional nervous disorders. Complement fixation in the cerebrospinal fluid was much less constant in its occurrence than were lymphocytosis and the globulin reaction.

Rheumatic Parotitis.—COURTOIS-SUFFIT and BEAUFUME (*Bull. et mém. de la Soc. méd. des hôp. de Paris*, 1910, xxvii, 3 s., 194) call attention to a complication of acute rheumatic fever which has never been described before—inflammation of the parotid gland. From the three cases reported by them, the inflammation is usually unilateral, and may appear either when the joint symptoms are at their maximum or at any time up to the beginning of convalescence. The process is of short duration and may clear up completely in from thirty-six hours to five days. The temperature may rise to 40° C. In two

instances the arthritis and parotitis were present simultaneously, while in the third case the arthritis ceased when the parotitis began and developed again on the disappearance of the parotitis. The authors believe that the cause of the parotitis is the same as the etiological factor of the arthritis, and they therefore, used sodium salicylate as treatment.

SURGERY.

UNDER THE CHARGE OF

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Bony Union of the Radial Diaphysis Obtained with the Use of an Immovable Metallic Ring.—MAUCLAIRE (*Archiv. gén. de Chir.*, 1910, vi, 140) calls attention to the difficulties often experienced in obtaining satisfactory union after a fracture of the radial diaphysis, whether the radius alone or the radius and ulna are fractured. Sometimes the four fragments are fused solidly together, more frequently the upper fragment of the radius is drawn to the ulna by the pronator teres and the lower by the pronator quadratus. He refers to a case in which from such a cause the patient was incapacitated 75 per cent. Wire suture of the bones leads frequently to a rarefaction of bone and interferes with union, even when the periosteum is carefully saved. He obtained good results from the use of an immovable metallic ring. This consists first, of an ensheathing plate, 4 cm. long, and underneath the upper part is a smaller plate furnished with four points which can be pressed by means of a screwdriver down on the fragments, which are thus approximated. By means of a second instrument the ring can be withdrawn. The wound is left open and packed with gauze, and the forearm is encased in a plaster bandage. In some cases non-operating treatment does very well, especially if there is little tendency to deviation of the fragments. When there is a persistent deviation of the fragments, operation becomes necessary. The metallic ring produces little traumatism of the bone, since it is not penetrated. The fragments are coapted by simple pressure.

Extension Treatment in Fractures of the Leg.—KNOKE (*Zntrbl. f. Chir.*, 1910, xxxvii, 497) says that after trying for a long time the Bardenheuer method of extension without satisfactory results, and later Rucker's modification, he has come to the employment of a method of his own, and finds it much more satisfactory. After careful padding of the foot, especially the dorsum to above the malleoli, a

plaster cast was applied with the foot in an easy position in dorsal flexion and supination. At each side a strip of canvas was inserted in the plaster for the support of the extension weight later. Before applying the plaster bandages, the midline on the extensor and flexor sides was marked by a strip of adhesive or something similar, in order that, before hardening, the plaster could be cut along these two lines and the cast divided into two lateral halves. These could be easily removed and just as easily reapplied. After its division it is held in place by a few turns of a bandage, and after it has hardened it becomes a plaster shoe. By employing sufficient padding in the first application of the plaster, the shoe still fits the foot when swollen. The results obtained from the use of this method have been very good. The deformity could be corrected and good functional results obtained. The following advantages are claimed for the method: It is very simple, cheap and frequently applicable. It overcomes the tendency to pointed toe deformity and flat foot, and immediately after the application of the shoe the amount of weight necessary to overcome the deformity can be attached, as it cannot be done by any other method.

Grossich's Tincture of Iodine Method of Disinfecting the Skin.—HESSE (*Zentrbl. f. Chir.*, 1910, xxxvii, 529) says that this method of disinfecting the field of operation is being employed by an increasing number of surgeons, and the large number of publications on the subject establish the excellence of the method. Some report that, in consequence of the employment of the official tincture of iodine, they had some trouble from iodine eczema. Grossich did not advise the use of the pure tincture, but of a 10 to 12 per cent. solution with alcohol, which was painted on the skin. The effective material is without doubt the iodine. Hesse has been employing a 20 per cent. solution with alcohol. He does not doubt, however, that the 10 to 12 per cent. solution is sufficient, so that one can choose any strength from 10 to 20 per cent. Hesse has not seen a single case of iodine eczema with a 20 per cent. solution, not even in the smallest children. If the pure official tincture is employed in the first preparation of the skin and then at each change of the dressing, many cases of iodine eczema must occur, so that in time this excellent method will be brought into disrepute. Grossich recommends that in emergency operations dry shaving be done, since the employment of water especially in a soapy solution, shortly before the operation, affects unfavorably the iodine disinfection.

A Case of Perforation of the Heart from a Gunshot Wound, without Perforation of the Pericardium, together with a Contribution Concerning Wounds of the Right Auricle.—LUXEMBOURG (*Deut. Ztschr. f. Chir.*, 1910, civ, 254) reports the case of a young man who a short time before his admission to the hospital had shot himself twice, the bullets entering the fourth and fifth right intercostal spaces close to the edge of the sternum. Three hours after admission he was operated on. The greater part of the sternum was resected. The anterior mediastinum was extensively extravasated with blood. Small portions of the third to the fifth ribs on the two sides were removed. A small opening was found in the left pleura through which air passed in inspiration

and expiration. By careful probing and dissection along the track of the bullet the surface of the pericardium was exposed. No opening could be found in it anywhere, but the first bullet was seen lying on the pericardium, and was extracted. The second was found two fingers' breadth higher alongside the superior cava, and was also removed without special difficulty. Because of the absence of any opening in the pericardium and scarcely any change in either bullet, the pericardium was not opened and the wound was closed without drainage. About ten hours later the patient died. The autopsy showed that the pericardium had not been wounded, but was tensely filled with blood, about 300 c.c. being removed. In the right auricle was found a lacerated, channelled wound, about 3 cm. long and about 1 cm. from the superior cava. It terminated in a small lentil-sized opening in the auricle. The number of similar cases in the literature is small, and in them the wounds of the heart are, usually, first detected on the autopsy table. Luxembourg collected 11 cases; 4 more cases are added in which a traumatic rupture of the heart occurred from gunshot wounds which did not reach the region of the pericardium. The force of the bullet in his case had so diminished on reaching the pericardium that it could not penetrate it, but was strong enough to produce a wound in the more delicate and easily lacerated auricular wall. On the basis of the fatal termination in this case, Luxembourg recommends that in every wound of the anterior mediastinum with an intact pericardium, especially when there is a suspicion of a wound of the heart, the exposed pericardium should be punctured to determine whether it contains blood or not from a heart wound. Rehn advises that an incision be made. Wounds of the auricle have been operated on several times in recent years. They probably heal spontaneously at times. Wilms' method of handling these wounds seems to be the best. In his case the wound in the left auricle could not be made accessible for the introduction of sutures into the beating heart. The auricle was drawn forward, and its posterior half, including the small wound, was ligated and the bleeding thus controlled. For gunshot wounds of the auricle, because of the gaping and laceration of the edges and the delicate and fragile muscle tissue, this method of closure is especially adapted.

Total Extirpation of the Bladder for Carcinoma.—PETROW (*Deut. Ztschr. f. Chir.*, 1910, civ, 365) removed the whole bladder for carcinoma in 2 cases and collected 62 cases from the literature. The mortality in these 64 cases is about 50 per cent., and is about the same as in other statistics collected during the past ten years. The first of Petrow's cases had had a papilloma removed from the bladder a year before. He then has a recurrence and was in a very poor condition. A laparotomy was performed, the two ureters were transplanted into the pelvic colon, and a drainage tube left in the rectum. Two weeks later the total excision of the bladder was performed by a combined pararectal and suprasymphyseal operation. The course afterward was favorable throughout, and in six weeks after operation the wound was completely healed. Nine months after operation the patient was in good condition. Rectoscopy showed a normal mucus membrane and clear urine. In the second case death followed thirty-six

hours after the transplantation of the ureters into the pelvic colon. Total extirpation of the bladder is a severe operation, but so is the condition in connection with which the question of operation arises. It is indicated in advanced carcinoma of the bladder, excision of which is insufficient and the opportunity for immediate suture slight. If the kidneys are still in good condition, a favorable result may be expected. If they are already severely diseased, as in Petrow's second case, any major operation will be very dangerous on account of the probable anuria. The operation should be done in two stages, the first, the transplantation of the ureters, being followed in one and one-half to two weeks by the second, the removal of the bladder. The transplantation of the ureters should be made into the colon, the laparotomy necessary for it permitting an exploration of the degree of extension of the tumor beyond the bladder and the determination of the chances of removing it.

Multiple Calculi in the Ureter of a Child Six Years Old.—EYNARD and RAFIN (*Ann. d. mal. d. org.-gen. urin.*, 1910, i, 673) made an attempt at extraction of the calculi by the transvesical route, but failed. After the bladder had been opened and the ureteral meatus dilated, a forceps was introduced into the ureter. The sensation of a foreign body was distinctly felt by the operator, but the stones could not be seized. Later an incision was made external to the border of the right rectus muscle and parallel with the groin. When the preperitoneal tissue was exposed the upper edge of the wound was strongly retracted upward. The search for the ureter gave some trouble. It was not found in the pelvic cavity nor where it crosses the iliac vessels, but was finally found anteriorly, slightly adherent to the peritoneum and dragged upon by the retractor. It was as thick as the thumb and looked somewhat like an intestine. After emptying it partially by a puncture, an incision 2 to 3 cm. long was made in it. The finger was introduced and an exploration made up to the bladder. The x-rays had shown shadows of 5 calculi. Only one could be found now, and this was removed by a forceps. Because of the size of the ureter it was thought that the stones had passed to the lumbar region. The upper part of the body was elevated but the stones did not pass into the pelvis. The finger could be passed in the ureter to the lumbar region but did not detect a stone. The incision in the abdominal wall was then extended to the lumbar region and the kidney exposed. When the finger was introduced into the renal pelvis the calculi were easily recognized and removed. A good result followed.

Transplantation after Resection in the Long Bones.—BITTNER (*Zentralbl. für Chir.*, 1910, xxxvii, 571) resected the lower third of the tibia for a myelogenous sarcoma. Almost the whole of the diaphysis was exposed by an incision and the tumor removed by the resection. The lower epiphyseal cartilage with a narrow border of periosteum remained. After freeing the inner side of the tibia of the soft structures, a hole was made from before backward by a drill, just internal to the tubercle of the tibia. By means of a Gigli saw and a chisel almost the inner half of the tibia from the tubercle down to the site of resection was removed. This piece of bone was turned to an angle of 180 degrees, so that its upper broad end presented below where it was fixed to the lower epiphys-

cal cartilage by a few silk sutures. The opposite end was fastened to the lower end of the tibia with a metallic suture. This brought the cancellous, upper end of the tibial graft against the lower epiphyseal cartilage and left the other end in contact with bone histologically similar. The remaining wound cavity was then filled with Mosetig's iodoform-lead. A drainage opening was made below and posteriorly, and the limb was surrounded with a plaster cast reaching above the knee. On the seventeenth day the sutures and the drain were removed, but the plaster cast was replaced and the child permitted to walk around in about six weeks. There remained a fistula at the site of the drainage from which, at first iodoform-lead and later, sequestra escaped, a sequestrotomy later becoming necessary. Consolidation of the graft took place, recurrence had not occurred at the time of the report and the function of the limb was good.

Intravenous Ether Narcosis.—PIKIN (*Zntrlbl. für Chir.*, 1910, xxxvi 673) reports his results in 16 cases by this form of narcosis, which was given by the Burckhardt method. Unconsciousness in all occurred with relative rapidity. It was uniform and simulated normal sleep. The stage of excitement was indicated only by increased frequency of the pulse. A few patients were given a preliminary hypodermic of morphine. Some complained of burning in the arm when the first portion of the infusion was introduced, but only for a half to one minute. In 2 cases there was some retching which disappeared as more ether was introduced. There was neither asphyxia nor rales during the narcosis and the pulse was of good quality. The postoperative course was even better. There was no bronchitis, pneumonia, or abnormality of the urine. In two laparotomies for severe gonorrhoeal peritonitis, there was a complete absence of any sinking of the blood pressure, which is not rare with inhalation narcosis. The only fatal case was that of a sixty-two-year-old woman, poorly nourished and anemic, with marked arteriosclerosis. She had a diffuse epithelioma of the cheek and angle of the mouth and involvement of the submaxillary lymph nodes. An hour before operation she was given a hypodermic of morphine. Four minutes after the beginning of the introduction of the ether solution, in which time 300 c. c. were given, the pulse suddenly dropped to 40 per minute, and the face became pale. Although the infusion was stopped, the pulse could not be counted and the breathing ceased. Immediately, artificial respiration was instituted and the heart massaged through an abdominal incision, but without avail. Pikin regards this as an unsuitable case for the method, and thinks that the morphine aided in producing a fatal termination. While the method has many advantages over inhalation narcosis, especially in operations in acute anemia, for peritonitis, and operations about the face and neck, he agrees with Kütner that it is not particularly free of danger, which comes particularly from the occurrence of emboli. In one of his cases there occurred a thrombus in the cannula, on account of fractional infusion, but fortunately no trouble developed from it.

A Simple Method of Performing Temporary Laminectomy.—HOFMAN (*Zntrlbl. f. Chir.*, 1910, xxxvii, 706) says that the indications for laminectomy have been increased considerably by the new operation of

excising the roots of the spinal nerves. His method of performing the operation is as follows: An incision is made over the spinal processes to the desired extent. The muscles are separated from both sides of the processes to the laminae, which are exposed to the transverse processes. The hemorrhage is controlled by packing, and the laminae on both sides are divided by a sharp flat chisel placed as horizontally as possible. This required only a few blows of the mallet for each arch. The interspinous ligament is then divided transversely above or below and the nearest loose spinous process is seized with suitable forceps. The osteoplastic flap consisting of periosteum, bone, and ligaments is thus lifted after any still binding structures are divided. As free an exposure as is necessary can be obtained. The dura is then opened by a longitudinal incision and the desired roots excised. The dura is closed by a continuous suture, the muscles sutured together, and then the fascia over the spinous processes and the skin. Only a half hour was required for the operation.

The Treatment of the Complications of Round Ulcers of the Stomach.—SPISCHARNY (*Archiv f. klin. Chin.*, 1910, xii, 172) reports the results in 110 cases treated in the surgical department of Moscow University. In 52 cases (47 per cent.), the ulcers were unhealed at the time of operation, and in 4 the ulcers had penetrated. All 4 died, 3 after operation. In 1 case after adhesion to the colon, a gastrocolic fistula had developed. Of the remaining 47, 2 were treated by resection, 1 was not operated on, and in 44 gastroenterostomy was performed. In 16 of these there were callous ulcers with pyloric stenosis. The immediate results were as follows: Death in 2, good results in 10, and improvement in 4. The permanent results in the 14 which lived were as follows: Good results in 7, improvement in 2, and death from unknown cause in 1. After gastroenterostomy there occurred no death from perforation of the ulcer. Consecutive hemorrhage developed five times, but was not severe enough to threaten the life of the patient. The immediate results in the 44 cases of unhealed ulcers treated by gastroenterostomy showed that good results were obtained in 33, improvement in 7, and death occurred in 4. In 5 cases the permanent results could not be learned, and one was operated on too recently to permit its inclusion with the others. In the remaining 34, there was a good result in 20, improvement in 6, formation of a peptic ulcer in 2, carcinomatous degeneration in 1, and death in 3. The objection is raised to excision of the ulcer alone or of the involved part of the stomach, that one cannot be certain that more ulcers do not exist. The immediate results of operation in 54 cases for cicatricial pyloric stenosis were good, 48 being cured, 5 improved, and 1 dying. The late results were about the same as in those cases in which the ulcers were unhealed at the time of operation. Spischarny concludes that in pyloric stenosis, from an unhealed ulcer or cicatricial stenosis, gastroenterostomy is indicated, because the immediate as well as the late results are so satisfactory. At times the normal lumen of the pylorus may be restored. The best method of gastroenterostomy is the posterior, with as short a loop of intestine as possible. The extent of intestine employed in the anastomosis is to be determined by the existence of dilatation or displacement of the stomach. The admixture of bile with the stomach

contents is usual after the anterior as after the posterior gastroenterostomy. It is evidently not dangerous, but rather an advantage. The gastric mucosa in ulcers and stenosis is considerably changed for some distance from the stenosed place.

THERAPEUTICS.

UNDER THE CHARGE OF

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The Treatment of Pseudoleukemic Glandular Disease with Arsacetin.—NAEGELI (*Therap. Monatsh.*, 1910, xxiv, 57) relates his results with arsacetin in the treatment of three cases of apparently typical pseudoleukemic glandular disease. He gave the remedy in doses of 0.05 gram three times a day. One very remarkable case had suffered from an irregular fever for a period of seven months, and had resisted all previous methods of treatment. After the internal use of arsacetin for two days the fever disappeared. During the following two months the patient gained thirty-one pounds in weight and he was apparently cured.

The Ambulant Treatment of Epilepsy with Sabromin.—FROELICH (*Therapie der Gegenwart*, 1910, li, 70) warmly recommends sabromin for the treatment of epilepsy. Sabromin, although it contains only one-fourth the amount of bromine contained by other bromides has an effect equal to that obtained by the other bromides. His average daily dose of sabromin was from 3 to 4 grams, given in either powder or tablet form. His patient, seemed to prefer the tablets which have no unpleasant taste. Froehlich observed no bromine acne from the long-continued use of sabromin, and speaks especially of the lack of any mental depression. He gives the details of fourteen cases, some of them under treatment for a period of ten months.

Veronal Natrium in Sea-sickness.—GALLER (*Therapie der Gegenwart*, 1910, li, 94) advises the use of veronal natrium for the treatment of sea-sickness. Galler has had good results by the use of veronal for this same condition, but veronal has the disadvantage of not being very soluble in water. Veronal natrium on the other hand, is soluble in five parts of water, and thus may be given in a concentrated solution which is rapidly absorbed and consequently more active. He gives one-half gram of veronal natrium dissolved in a small amount of water twice in twenty-four hours. If the patient is able to retain it for about ten minutes, which is with few exceptions the rule, there will be a relief from vomiting and nausea, lasting from ten to twelve hours. In mild cases, a single dose of a half gram at bedtime is usually sufficient.

Circulatory Failure in Acute Infections of Children: Causes and Treatment.—HOWLAND (*Boston Med. and Surg. Jour.*, 1910, clxii, 627) says that critical clinical observations and animal experimentation are in accord in referring the cause of circulatory disturbance in acute infections to a failure and final collapse of the vasomotor centre. There is also almost complete agreement obtained by animal experiments and by modern methods of determining the human circulatory capacity as to the drugs and methods most useful in this circulatory disturbance. He says that from the knowledge at present available, it seems that the continuous use of cold air, the use of caffein and camphor, reinforced by digitalis with infusions of salt solution and the careful administration, not too often repeated, of adrenalin, are our best methods to combat this dangerous condition.

The Treatment of Acute Dysentery by Intestinal Irrigation with a Five Per Cent. Solution of Silver Nitrate.—HEWES (*Boston Med. and Surg. Journ.*, 1910, clxii, 530) advocates the use of stronger solutions of silver nitrate in the treatment of acute dysentery than those ordinarily recommended. He used injections of a 5 per cent. solution of silver nitrate for the treatment of 10 cases. The treatment was instituted at an early stage, from the second to the fourth day of the diseases as so judged by the appearance of symptoms. The average duration of these 10 cases was ten days and the maximum duration, seen in 1 case, was fourteen days. Hewes gives the details of the treatment as follows: The patient when first seen was given a dose of magnesium sulphate. As soon as this drug had acted, irrigation by silver nitrate was given. The rectal tube was inserted from 8 to 12 inches and a pint or more, according to the capacity of the patient to hold the solution, of 5 per cent. silver nitrate, was injected. The injection was retained by the patient as long as possible, up to a half hour. Defecation was then allowed. Rectal injections of salt solution were given regularly after each movement during the course of the treatment. A second injection of silver nitrate was, as a rule, given after a period of two days. In some cases one injection only was used. A diet selected with the idea of reducing the amount of fecal food residue was given. The daily content of this diet was as follows: Lean meat, 300 gm.; three slices of toast with maple syrup; albumin water consisting of the white of 8 eggs in water. This was continued for five days. The diet was then increased by the addition of more toast, butter, tapioca, potato juice, and macaroni.

Digistrophan, a New Cardiac Tonic.—BOELKE (*Therapie d. Gegenwart*, 1910, vi, 153) has used digistrophan in the treatment of 85 patients with circulatory disturbances as a heart stimulant and speaks very highly of its good effects. Digistrophan is a combination of digitalis leaves and strophanthus seeds, and may be obtained in tablet form, each tablet containing 0.1 gr. digitalis leaves and 0.05 gr. strophanthus seeds. Boelke says that this new remedy has no cumulative action and has no irritant action upon the gastro-intestinal tract or the kidneys. Furthermore, digistrophan is stable and its tonic action consequently is constant. Digistrophan has a marked diuretic action, but in order to increase this diuretic action, tablets may be obtained containing digistrophan in combination with sodium acetate or with caffein-sodium acetate.

The Treatment of Chronic Constipation and Acute Intestinal Paresis with Peristaltic Hormone. ZUELZER (*Med. Klinik.*, 1910, vi, 422) calls attention to a previous paper in which he described a hormone formed by the cells of the gastric mucous membrane that has a specific regulating action upon intestinal peristalsis. This hormone, he believes, occurs in all the organs of the body, but is especially abundant in the spleen. From the spleen it is now prepared commercially under the name of peristaltic hormone. Zuelzer tried this remedy in 21 cases of chronic constipation with a permanent curative result in 15, after a single intramuscular injection. On the other hand there was no effect in the remaining 6 cases. Zuelzer thinks that this remedy has a direct stimulating action upon the intestinal musculature and thus may be of great value in cases of acute paralysis of the intestine. The injections are harmless, although they cause a slight febrile reaction and slight local tenderness.

Peristaltic Hormone.—SAAR (*Med. Klinik.*, 1910, vi, 424) reports three cases of chronic constipation treated by a single intramuscular injection of from 15 to 20 c. c. of peristaltic hormone (Zuelzer). These three patients for a considerable time afterward had no return of their trouble. This treatment, however, was not uniformly successful. Saar thinks it advisable to give the injection early in the morning in order that the febrile reaction that usually ensues may subside.

The Treatment of Chronic Constipation with Agar-agar.—MARTINET (*Presse md.*, 1910, xxvi, 226) recommends the use of agar-agar for the treatment of chronic constipation. Agar-agar absorbs sixteen times its weight in water and promotes peristalsis by distending the intestine. Thus it is valuable in that type of chronic constipation due to too little residue from the food. He gives the agar-agar in doses of from 5 to 15 grains taken at breakfast in some sweet, such as fruit jelly or marmalade. It may also be given in a thick soup. Martinet prefers to give it in combination with food, although it may also be given in compressed wafers. In order to enhance the peristaltic action, Martinet at times combines small doses of cascara with the agar-agar.

Sarton, a New Food for Diabetics.—VON NOORDEN and LAMPE (*Therapie d. Gegenwart*, 1910, li, 145) acting upon the theory that protein of vegetable origin is tolerated by diabetics better than protein of animal origin, have experimented with the Soya bean. The Soya bean contains from 30 to 35 per cent of protein and only 6 per cent. of starch and fermentable carbohydrates. The Soya bean forms one of the staple articles of diet, especially among the poorer classes of Japanese. When prepared as a simple vegetable or salad the Soya bean is very unpalatable and leaves an unpleasant taste that persists for a long time after taking it. Von Noorden found that the Soya bean thus prepared had no favorable influence upon the sugar excretion in diabetics. Finally a method was obtained to render the Soya bean palatable and at the same time remove the starch and fermentable carbohydrates. This method was perfected commercially and the manufactured product may now be obtained under the name of sarton. It is best given in the form of soups, in which it may be combined with butter and meat

broths. Soup, thus prepared, is very palatable and is a valuable adjuvant to the diabetic diet. Sarton may be used as flour is used in ordinary diets to thicken gravies and sauces for diabetics. Furthermore, the authors believe that Sarton is not only of value as a diabetic food, but also may be given to supply protein in cases of gout or kidney disease in which protein of vegetable origin is tolerated better than protein of animal origin. Sarton has the further advantage that it increases intestinal peristalsis without the formation of gas that other leguminous foods produce.

The Treatment of Chronic Intestinal Catarrh with Injections of Hot Gelatin.—VON ALDOR (*Therap. Monatshefte*, 1910, xxiv, 171) reports excellent results with hot gelatin injections in the treatment of chronic catarrh of the large intestine associated with diarrhœa. He injects from 40 to 80 c.c. of a 10 per cent. solution of gelatin at a temperature of from 113° to 125° F. This solution is slowly injected through a tube, inserted into the rectum for at least five inches, because of the extreme sensitiveness of the sphincter muscle to heat. The injections are preferably given with the patient lying on the left side. After the injection the patient should lie still for two hours with heat applied to the abdomen. Von Aldor reports 7 cases treated by this method, with a complete cure in every case. He calls attention to the value of gelatin in the dietary of patients with a chronic intestinal catarrh, as recommended by Senator and Herter. Weil, Lumière, and Péhn have found that gelatin by the mouth is most efficacious in the treatment of the diarrhœa of infants, but so far as von Aldor knows, he is the first to recommend the use of gelatin by the rectum for the treatment of chronic intestinal catarrh.

Hypertension and the Value of the Various Methods for its Reduction.—MILLER (*Jour. Amer. Med. Assoc.*, 1910, liv, 1666) relates his observations as to the value of various procedures for reducing abnormally high blood-pressure. He states that since some samples of nitroglycerin and sodium nitrite are inert, the activity of the preparation employed was first determined by animal experimentation. Miller's conclusions are as follows: (1) In moderate doses active preparations of nitroglycerin and sodium nitrite temporarily reduce the blood-pressure in the majority of cases of hypertension. (2) Erythrol tetranitrate causes a more prolonged reduction in blood-pressure than nitroglycerin or sodium nitrite, but so frequently causes severe headache that its clinical value is much impaired. (3) Headache after any vasodilator does not mean that we are getting the physiological effect in the sense that the blood-pressure is reduced, as the headache may appear independently of any change in pressure. A patient's blood-pressure may be decidedly affected by one of these vasodilators and uninfluenced by another. (4) Occasionally the blood-pressure of patients with marked hypertension may show very marked fluctuations without apparent cause. (5) A single sweat reduces hypertension less than a moderate dose of vasodilators. If sweats are given daily, a rather marked reduction of pressure lasting throughout the day, is observed not infrequently. When the sweats are discontinued the blood-pressure soon returns to its previous level.

PEDIATRICS.

UNDER THE CHARGE OF

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Citrated Milk for Wasting Infants.—FREDERICK LANGMEAD (*Proced. Royal Soc. Med.*, 1910, iii, 103) reports 80 consecutive cases of wasting infants fed on undiluted citrated milk. Sodium citrate renders the curd in cow's milk more flocculent and soft, thereby overcoming the effect of the ordinarily hard, tough curd. Citration has usually been employed with dilution of the milk. But dilution increases the bulk of the mixture and tends to gastric distention. It also reduces the percentage of fat and sugar to proportions below that of human milk, and the process is complicated for the mother. The 80 cases reported consisted of 41 girls and 39 boys. The age at first attendance varied from three weeks to four months. All the cases were much under weight when first seen and most of them showed gastric and intestinal disturbances. They were all fed on undiluted citrated milk and close account was taken of their weight from time to time. The amount of milk was graded to the child's age. Citrated milk was not used on children under three weeks of age. Two grains of sodium citrate are added to each ounce of the mixture. It is usually dispensed in a watery solution and the requisite quantity added after bringing the milk to a boil. The child is brought back every week to be weighed and inspected. Citration is gradually lessened at about five months and omitted at six months. Its advantages are its simplicity, absence of manipulation, and cheapness. Objections have been raised to the amount of protein in whole milk, but Langmead believes the nature of the curd causes as much trouble as the protein. Constipation was not noticed more than in any other method of feeding. In 150 cases he has not seen œdema or urticaria due to increased coagulability of the blood. When this occurs it is probably due to too large doses. The results in the 80 cases cited were a uniform and often marked increase in weight in all cases, with improved or perfect gastric and intestinal efficiency—which tends to prove the value of this form of feeding for this class of infants.

Enlargement of the Thyroid in Rheumatism.—J. R. CLEMENS (*Archiv. Pediat.*, 1910, xxvii, 353), since reporting a series of cases of rheumatism in children accompanied by enlargement of the thyroid gland, has noticed so frequently this condition in rheumatic disease in childhood that he now considers it a sign of rheumatism. Enlarged thyroid may be noticed before, during, or after the course of the disease. The degree of enlargement is not great but is sufficiently pronounced to give unnatural fullness to the neck, especially when viewed laterally. In children with enlarged thyroid glands a careful history should be taken in reference to growing pains, torticollis, and recurrent tonsillitis. There are a few references of the association of exophthalmic goitre with rheumatism.

Human Rickets as an Infectious Disease.—STEPHANO MIRCOLI (*Münch. med. Woch.*, 1910, lvii, 1127) in answer to a statement describing a diseased condition of the bones morphologically like osteomalacia and induced in rats by a diplococcus, states that in 1891 he isolated and cultivated organisms from the bones and central nervous system of children who had died during the first stages of rickets. These microorganisms belong to the order of physiologically human bacteria, being staphylococci, streptococci, and colon bacilli. Having confirmed these observations experimentally and by histological investigation, he concluded that human rickets is the result of an infection, mostly an auto-infection, from bacteria present physiologically, especially those from the intestinal canal. In 1894 he demonstrated experimentally the staphylococcic autoinfection from the intestine.

Methods of Avoiding and Controlling Epidemics of Poliomyelitis.—PAUL ROMER and KARL JOSEPH (*Münch. med. Woch.*, 1910, lvii, 945) discuss ways and means of preventing or cutting short epidemics of poliomyelitis. Prophylaxis must cover first the methods by which the virus of the disease is carried or spread. They state that domestic animals or pets, such as dogs, do not come under suspicion as carriers of the infection. It is more probable that the virus is contained in secretions of the nose and mouth and in this way the infection is spread by healthy carriers. Attention is called to the similarity between meningitis and poliomyelitis. Flexner and Lewis showed, experimentally, that the secretions of the nose and mouth in an ape suffering from poliomyelitis were capable of causing the disease, and therefore contained the infective element. It is not improbable, therefore, that the disease in children is spread by carriers with mild constitutional symptoms but with infective secretions, direct contact with these carriers conveying the infection. The virus, even when subjected to a process of drying for days, shows such tenacity and strength that the possibility of the spread of the disease through dried expectoration must be considered. Ordinary disinfectants are inadequate, but experiments on infected rooms show that formaldehyde disinfection killed the virus in seven and a half hours. As regards serum treatment in this disease, Römer and Joseph believe that there are specific antibodies in the serum of animals in which poliomyelitis has been induced, and that a safe and effective method of serum vaccination against the disease is possible. They have proved this possible by experiments on apes, having successfully vaccinated apes with a mixture of this virus and the antiserum. After vaccination these apes were unaffected by injections of the virus, which in the controls not previously vaccinated caused the typical disease and death. They therefore conclude that the serum of apes which have recovered from an attack of poliomyelitis, or have been properly and thoroughly immunized by vaccination, counteracts or destroys the active principle of the virus by long contact within the body. The further proof of specific, obtainable antibodies in poliomyelitis may be expected with surty.

Nursing Infants as Typhoid Carriers.—ROMMELER (*Münch. med. Woch.*, 1910, lvii, 956) states that Koch's campaign against typhoid fever has demonstrated that children and nursing infants are often responsible for the spread of this disease. The investigations of Conadi and others show

that mild and unsuspected typhoid infection in children takes an actual part in spreading the disease from family to family. While small children are not as prone to typhoid as adults, yet the mildness of the course and symptoms of the disease in children makes it hard to take timely and proper precautions against its spread. A young woman who was nursing a child one and a half years old developed typhoid and was removed to a hospital. The child was taken in by a neighboring family who took care of it. It was noticed that the child had a slight diarrhoea and seemed slightly unwell for a short time. Within two weeks the mother of this family developed typhoid. During the next two weeks this woman's three children, her niece who was visiting her, and a servant who lived with the family all developed typhoid, and the servant died from it. As a further proof that the infected baby was the cause of the six cases of typhoid, it was carefully examined with the result that two positive Widal reactions were obtained from its blood and typhoid bacilli were twice isolated from its feces. The child itself had shown only a short, slight indisposition and a mild diarrhoea when it was taken in by this family. Such instances show that unsuspected or undiagnosed typhoid infection in children, and especially in nursing infants is an important factor in the spread of the disease. Rommeler states that when a woman develops typhoid fever while she is nursing an infant, both infant and mother should be sent to a hospital, or the infant be treated with the same careful restrictions as if it had typhoid fever. This plan will prevent the spread of the disease by infants.

OBSTETRICS.

UNDER THE CHARGE OF

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The Care of Pregnancy and Labor Complicated by Nervous Overdevelopment.—NEWELL (*Surgery, Gynecology, and Obstetrics*, March, 1910) draws attention to the increasing number of patients who are badly developed, poorly nourished, and by reason of excessive nervous susceptibility are bad cases for parturition. In attempting to care for such in labor, not only must the pelvis be accurately measured, but a careful estimate made of the relative size of mother and child. A second consideration of importance is the estimate of the muscular power of the individual patient and the prompt resort to operative delivery in those women unfit for labor, before exhaustion develops. The nervous resistance of the patient is a most important factor, and may determine the choice of the method of delivery. Many women are overtaxed by the demands of society, or by the effort to attain high scholarship in women's colleges. Another group of patients demanding especial attention are those who have always been sickly and delicate, and whose lives have been preserved by unusual care.

These women are often unfit for parturition. Those patients who develop a lack of accommodation to pregnancy, manifested in the development of toxemia, form a considerable class whose care demands especial consideration. In prophylaxis the effort should be made to limit the overstrain which modern education and society bring upon young women. During pregnancy each case must be studied individually, and at the time of labor such methods adopted as are likely to prove successful. To prevent the nervous shock of labor, anesthetics may be early employed, and in Newell's experience morphine and scopolamine, in graded doses, have given good results. Delivery should be accomplished as soon as possible by appropriate surgical means. It is equally important that such patients be given special care during convalescence. The repair of lacerations, exercises which tend to develop and strengthen the pelvic and abdominal muscles, and rest in bed for three weeks after confinement, are all important. In choosing a method of delivery, if the pregnancy be the first, and the patient has had repeated miscarriages, unusual value may be placed upon the life of the child. If the patient has passed through previous labors and has done badly, the effort must be made to ascertain the reason for the unfavorable result, so as to avoid a second failure. The indication for the elective Cesarean section in competent hands should be extended, and will give the best results for mother and child in many of these cases.

The Treatment of Placenta Prævia.—HAUCH (*Monatsschrift f. Geburts. und Gynäk.*, Band, xxxi, Heft 5, 1910) reports the results of the treatment of placenta prævia in 240 cases in the Copenhagen clinic. Dilatation of the cervix by Bossi's dilator and vaginal Cesarean section were not considered suitable operations for placenta prævia. The classic Cesarean section was not performed for this indication. Among the 240 cases there were 18 or possibly 20 coming within the indications given by Sellheim, Bumm, Küstner, and Pfannenstiel, for extra-peritoneal section. In view of the lack of extensive experience in this operation for placenta prævia, these cases were delivered by other methods.

The examination of the result shows that the 240 cases were observed in 24,000 parturient women, giving a frequency of 1 per cent. Of these, 22 mothers perished, a mortality of 9.1 per cent.; of these patients, 144 were treated by the use of elastic bags, with a mortality of 16, or 11.1 per cent. Among these were 60 cases of central placenta prævia, and 84 cases of partial placenta prævia. Among these patients the elastic bag was placed outside the ovum in 96, with a maternal mortality of 15.6 per cent.; while the bag was placed within the cavity of the ovum in 48, with a mortality of 2.1 per cent.

The Braxton-Hicks method of delivery was employed in 18 cases, with no maternal mortality. Of these, there were 6 cases of central placenta prævia, and 12 of partial. In the whole series the most common cause of death was hemorrhage and exhaustion. Septic infection proved fatal for the mothers in 1.2 per cent. of cases. The mortality of central placenta prævia was 15.3 per cent.; of partial placenta prævia, 5.8 per cent. Of the 144 cases treated by the use of dilating bags, there were 28 primiparæ, with a mortality of 3.6 per cent., and 116 multiparæ,

with a mortality of 5.2 per cent. In these patients there were 235 in whom the ovum was sufficiently developed to be classed as a foetus. The mortality among these was 62 per cent. In cases in which the dilating bag was used without the cavity of the ovum, the foetal mortality was 44 per cent.; and in which the bag was introduced within the cavity of the ovum, the foetal mortality was 52 per cent. In central placenta prævia the foetal mortality rose to 65 per cent., and in partial placenta prævia to 44 per cent.

In cases of infection the origin of this complication could be ascribed, as a rule, to the introduction of the tampon, often before the patient had been brought to hospital. The prolonged use of the bag for four or five hours also predisposes to infection. This danger was greater when the bag was applied outside the cavity of the ovum than when it was introduced within the ovular cavity, and the conclusion is reached that it was unjustifiable for this reason to hasten labor in placenta prævia by the use of the elastic bag. In 11 cases, considerable laceration of the cervix was observed, and among these there were 9 which had been treated by the use of the elastic bag. Lacerations which are not extensive are often overlooked, but as they give rise to hemorrhage and infection they furnish a considerable complication. Wherever the extraction of the child was difficult, laceration was inevitable. It is advised that a bag at least 10 cm. in diameter should be employed for dilatation, so that as complete dilatation as possible may be obtained. The operator is cautioned that if in version and extraction the operation does not proceed readily, he should desist and allow the child to be spontaneously expelled. In 70 per cent. of cases in which the elastic bag was employed a weight was attached to the bag to hasten dilatation. Among these patients there were five severe lacerations of the cervix, with two deaths from hemorrhage. The bag remained in position in these cases between five and six hours on the average. Where a weight was not attached to the bag, lacerations were much less frequent and severe, and the bag remained between three and four hours on the average. In primiparae the use of the bag was prolonged to over six hours, and when a weight was attached to the bag the average duration of its use was seven and nine-tenths hours, while without a weight four and four-tenths hours usually completed dilatation. It is difficult to decide whether the use of the weight could be definitely assigned as the cause for lacerations, but the results were carefully observed, as stated. The operator is urged to be excessively cautious in version and extraction in placenta prævia, and especially after the use of dilating bags. The weight should be attached to the bag only in those cases in which there is considerable hemorrhage or the labor is unduly prolonged. If the interests of the mother alone are to be considered, and especially if the patient cannot be brought to the hospital, the Braxton-Hicks method remains the safest and most applicable.

The Control of Hemorrhage in Placenta Prævia.—KUPFERBERG (*Monatsschrift f. Geburts. und Gynäk.*, Band xxxi, Heft 5, 1910) calls attention to the former statistics of the mortality of placenta prævia as 50 per cent. for the mothers, and 90 per cent. for the children. At least one-half of the maternal mortality arose from hemorrhage. Recent

statistics in general practice give a maternal mortality of 20 per cent. for mothers, which is reduced in hospitals to between 5 and 6 per cent., while the mortality for children in private practice, in cases of placenta prævia, is 60 per cent., reduced in hospitals to 20 per cent. The writer refers to 3 cases of death from hemorrhage in placenta prævia in his experience of eighteen years of obstetric practice. All occurred from extensive lacerations of the cervix which could not be controlled by suture and the use of the tampon and other means. He draws attention to the common mistake of proceeding to rapid extraction after turning by the Braxton-Hicks method. The chance of saving the life of the child is so slight, and the increased risk to the mother is so great, that immediate extraction is not justifiable. He has observed lacerations so extensive that bleeding occurred beneath the peritoneum in a region inaccessible to suture from below. Among others, the writer describes the case of a multipara upon whom version and extraction had once been performed because of eclampsia. She suffered at that time from severe laceration of the cervix and perineum. The cervical laceration did not heal, and although the perineum was closed there remained a rectovaginal fistula. Other pregnancies proceeded successfully, but in the forty-first week of the last pregnancy the patient was taken with sudden hemorrhage. On examination there were no labor pains, the cervix permitted the entrance of one finger, the placenta prævia was lateral, and the child in transverse position and viable. The vaginal tampon was immediately applied. After twelve hours there was a renewed severe hemorrhage, with the expulsion of the tampon. The patient was then transported to the hospital, the membranes ruptured, and an elastic bag introduced. Six hours afterward the bag was expelled with repeated hemorrhage and prolapse of the umbilical cord, which pulsated feebly. As the patient desired, if possible, to save the child, the cervix was dilated as completely as possible by bags, and version and extraction performed. The child was born asphyxiated and could not be revived. Very severe hemorrhage followed delivery, complicated by a deep laceration of the cervix upon the right side extending through the vaginal tissue. Although the uterus contracted well, hemorrhage persisted. Momburg's method of compression was tried without result. The laceration was closed by sutures under inspection with the aid of a speculum. The uterus and vagina were tightly packed and compression bandages placed upon the abdomen and perineum. Ergotin and salt solution were given hypodermically. An hour after the application of the tampon the gauze was blood-soaked and the patient in collapse, with a pulse of 150. As a last resort the abdomen was opened and supravaginal amputation of the uterus performed. The patient rallied, recovered without fever, and was discharged in good condition six weeks later. The peritoneal laceration which had been sutured was subsequently repaired. When the patient was discharged there was a firm scar with some contraction of the tissue at the right upper extremity of the vagina. In this case, 500 c.c. of salt solution was used to distend the bag. The child weighed nine pounds. In the literature the writer has collected three cases in which extirpation of the uterus was performed for uncontrollable postpartum hemorrhage. These three cases resulted successfully.

The Importance of Resistance of the Soft Parts during Labor as Influencing Foetal Mortality and Maternal Mortality.—SEITZ (*Archiv f Gynäk.*, 1910, Band xc, Heft 1) contributes an elaborate paper from Döderlein's clinic in Munich, illustrating this subject. After reviewing the different conditions in which prompt delivery may become necessary, he draws attention to the importance of abnormalities and undue resistance on the part of the soft portions of the genital canal as influencing foetal mortality and maternal mortality. He draws attention to the value of vaginal hysterotomy as the most efficient method of overcoming these conditions. He also calls attention to the fact that in good hospitals and in competent hands the mother's dangers are not increased by this procedure. In 5036 parturient patients in Döderlein's clinic there were nine deaths from puerperal sepsis, a mortality of 0.17 per cent., and in these are included a number of cases infected before admission to hospital. Of these 9 patients, 2 had abdominal Cesarean section, undertaken in the interests of the child. No mother perished from operation undertaken to overcome abnormalities in the soft portions of the genital canal. Between the years 1900 and 1904, in the Munich clinic, the mortality for five years of parturient women was 0.308 per cent. Since vaginal hysterotomy has been employed the mortality has grown less rather than more. When foetal mortality is considered, there were 117 foetal deaths among these cases, of which, 19.7 per cent. could be ascribed to abnormalities in the muscular and elastic tissues. In previous years, the mortality from this condition among the children was 29.4 per cent.; in recent years the mortality of children in contracted pelvis was 9 per cent., while formerly it was 17.3 per cent. It is hoped that the foetal mortality may be reduced to 1 per cent. by suitable operation. Attention is called to the importance of transferring all complicated cases of labor as soon as possible to suitable hospitals.

GYNECOLOGY.

UNDER THE CHARGE OF

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Actinomycosis of the Uterine Appendages. CARL WAGNER (*Surg., Gyn., and Obst.*, 1910, x, 148) believes actinomycosis of the uterine appendages is practically always a secondary affection from the gastrointestinal tract, perhaps most frequently from the vermiform appendix. The mode of infection is thought to be by infiltration, penetration, continuity, and contiguity. After the acute stage the infected appendage becomes surrounded by dense connective tissue formation, which may lead to erroneous diagnosis of different kinds of tumors of hard consistency. In many cases the gross macroscopic and the microscopic pictures are often mistaken for tuberculous invasion. Wagner says

Bollinger's desideratum for the diagnosis of actinomyces, namely, that corpora flava must be present, is untenable at the present time. Repeated bacteriological examinations, and sometimes long and tedious ones of the same specimens, must be made, to insure a correct interpretation of suspicious pathological material. Inoculation with pure cultures into the animal is not attended with success. Only the injection of pus with actinomyces, or the ingestion of material upon which actinomyces is grown, will prove successful in the production of actinomyces in the animal. Actinomyces does not travel by the lymphatics, and probably not by the blood route. The prognosis is favorable in circumscribed cases, which is most likely the condition in which we find the uterine appendages. The treatment consists in radical extirpation and free drainage; the application of tribromphenolbismuth, or irrigation of the fistula with copper sulphate, and the internal administration of large doses of iodide of potassium up to 75 grains a day, which exerts a positive healing effect. A careful study of apparently innocent pus from pelvic disease, as well as secretions from obstinate fistulas after laparotomies from ovarian and tubal pus infections may result in finding actinomyces more commonly to be the cause of the pathological changes than has been the case heretofore, and in consequence, different treatment inaugurated should insure, perhaps, a higher percentage of final cures.

Primary Cancer of the Fallopian Tube.—DORAN (*Jour. Obst. and Gyn., Brit. Empire*, 1910, xvii, 1) has tabulated 38 cases of primary cancer of the Fallopian tube. Ten of the patients were between forty-five and fifty years of age when the disease was detected; 7 between fifty and fifty-five; 6 between forty and forty-five; and 5 between fifty-five and sixty; 2 had passed their sixtieth year; 3 were between thirty-five and forty; 2 were under thirty, and in 3 the age was not given. Of 100 Doran has collected, the youngest age found recorded was twenty-seven years. From this data it is plain the disease rarely occurs before the menopause, but is most common at or shortly after that period of life of the woman. Nineteen had been one or more times pregnant, 8 were reported as sterile, and in 11 no record was found. In 2, symptoms, principally menorrhagia and vaginal discharge, had existed three years, but usually the symptoms had lasted one to twelve months; pain was present in 25 cases, but in many of these the disease had invaded other structures. In 34 a swelling of some kind was noted, ranging from distinct resistance in a vaginal fornix to an abdominal tumor, but in several there were uterine or ovarian tumors as well. In one, marked ascites was present, and in another to a less degree. In over 27 per cent. of recorded cases of primary cancer of the Fallopian tube free watery vaginal discharge was a marked symptom. Uterine fibroids and ovarian cysts, exclusive of tubo-ovarian cysts, were each present in 4 cases. Doran insists the fimbriated end of the tube closes very early in primary cancer of the tube in contrast to the lateness in benign papilloma of this structure. In 9 there was a distinct history of pelvic inflammation, and in 12 a doubtful one, while in 17 there was no reliable clinical history. In 12 the disease was bilateral, in 10 on the right side only, and in 12 in the left. Two others were unilateral, and in 2 no statement regarding this point was made. Thirty-seven of the patients

were operated upon, but the after histories are so incomplete as to be nearly valueless. Doran states primary cancer of the tube is clearly not a malady of extreme rarity, and that as in at least 27 per cent. of all cases distinct and more or less free watery discharge was present, it is clear that when that symptom is found to be associated with a pelvic or abdominopelvic tumor, that an exploratory operation should be performed, and if a tumor of the tube is detected, the uterus and remaining appendages, as well as the effected tube, should be removed.

Genital Hemorrhages in Cases of Hemophilia.—L. FRÄNKEL and L. BÖHM (*Monats. f. Geb. u. Gyn.*, 1909, xxx, 417) report 7 cases of hemophilia in which uterine hemorrhage was marked. One case proved fatal. In 2 cases there was a family history of hemophilia, and in the other 5 the condition was considered sporadic. The question of hemophilia arises often in cases of menorrhagia and Fränkel and Böhm would accept only such cases as genuine which show an excessive menstrual flow, with intact genitalia, resisting for a long time the usual therapeutic measures, and which have either a family history of hemophilia or a tendency toward severe hemorrhages from other organs. In the literature they find 151 cases of hemophilia in women, 46 of which they consider doubtful. Of the 151 cases a family history of hemophilia was obtained in 99 cases, excluded in 34, and doubtful in 18. They do not find that hemophilia necessarily makes its appearance with the establishment of menstruation, nor that this function is always of grave danger in such women. At least 100 cases of pregnancy complicating hemophilia are recorded. Only once was there hemorrhage before the expulsion of the placenta. In 56 cases the hemorrhage was severe and in 5 fatal. Severe hemorrhages need not necessarily be expected at the time of labor, but there seems to be an increased tendency for hemorrhages late in the puerperium. In general women with hemophilia suffer from uterine hemorrhage, yet as compared with men the prognosis is not made more unfavorable on that account. Fränkel and Böhm advise against marriage, and recommend internal treatment for the condition and local treatment for the uterine hemorrhages, of which firm packing of the uterus and vagina is considered the best.

DERMATOLOGY.

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Radium and Radiotherapy in Skin Diseases.—LOUIS WICKHAM, of Paris (*Brit. Jour. Derm.*, November, 1909, p. 357), discussed this subject before the British Medical Association, held at Belfast, the following

being a summary of the article. Radium is employed (1) in glass tubes, which may be introduced into the passages of the body or into growth; or (2) in the form of a varnish, on some metallic base or on linen. The use of filtration by screens composed of aluminum, lead, or other substances has brought about a complete change in the treatment with radium. The quantity of the rays can be modified by employing screens of varying degrees of thickness, and their quality is changed because of the alteration in their penetration. Radium may be applied (1) direct to the surface, when the rays are very numerous, useful in superficial disease (as in lichen patches); and (2) with medium filtration, the rays being less numerous for deeper-seated diseases (as carcinoma cutis); and lastly, (3) with dense filtration, the rays being few in number and very penetrating for deep-seated growths. It is not always necessary to produce inflammatory reaction, because the rays have a specific effect, and if a deep action is called for the application may be prolonged without setting up any surface inflammatory reaction. The radium apparatus may be used in various ways, as by holding it in the hand, by fixing it with pincers, or by employing supports of one kind or another (as a catheter); it may also be used in gray oil and in waters (as washes and baths). Dermatitis (as of the hands) may follow the employment of radium by the operator, precisely as in the case of Röntgen rays. The large and important new field seems to be gradually opening in therapy by this agent.

Treatment of Nevus by Radium.—LEWIS JONES (*Brit. Jour. Dermatology*, November, 1909) states that vascular naevi are favorably influenced by the radiations of radium, thus confirming the experience of other observers. Twenty-four cases were treated in the electrical department of St. Bartholomew's Hospital. The specimen of radium used consisted of 15 mg. of radium bromide with a radio-activity of 500,000, enclosed in an aluminum capsule or button 1 cm. in diameter, giving off a uniform radiation from the entire front surface of the button in any position. The button is fixed on the part to be treated, with a layer of thin gutta-percha tissue interposed. The time was generally one hour. All were small, actively growing, florid naevi in young babies, and all underwent retrogressive changes after the first application of the radium. Usually reaction manifests itself in five days, in the form of redness of the surface, followed very soon by a gradual flattening of the nevus if it has been previously raised; then paleness sets in, with slight desquamation or the formation of a thin, dry scab, which falls off and reforms several times, while the nevus continues to become paler and less defined in outline, finally fading away and the skin assuming a natural appearance, though retaining for some time a faint pink image of the original nevus. No sore or moist surface was observed. The whole process of evolutions requires from four to six weeks. Half the number of cases were completed with a single application; six required a second application.

Radium: Its Therapeutic Value.—W. D. BUTCHER (*Brit. Med. Jour.*, September 12, 1909), well known as a worker in this field, describes its employment for the cure of thickened states of the skin after scarring from rodent ulcer, in lupus vulgaris, carcinoma cutis, nevus, and for the

relief of the itching in pruritus. It is also recommended for the treatment of the lesion of primary syphilis, while it has also proved useful in secondary infiltrations. The author makes use of 10 mg. of radium bromide from Brunswick, said to have a radio-activity of 1,800,000 "uranies."

Treatment of Lupus Vulgaris.—PROF. E. LANG, of Vienna (*Deut. med. Woch.*, October 7, 1909), gives a summary of his labors at the "Lupus-Anstalt," with a record of cure in 262 cases of lupus out of 291 patients examined six months after the end of the treatment. From the year 1892 to date 412 cases were treated. This favorable result is attributed to a combined Finsen light and operative treatment together with general remedies. A note of warning is sounded against the actual cautery and the sharp curette, which leave scars, and thus interfere with the good effects to be derived from the Finsen light. The author believes that the disease may be due to some internal centres of infection as well as from external local causes. [One of us has recently visited this famous Institute in Vienna, and can speak from observation of the excellent work done for the cure of this disease.]

Acute Septic Pemphigus.—JOSEPH GRINDON (*Jour. of Cutaneous Medicine*, October, 1909) gives the notes of a case and considers the subject in its several aspects, especially its relation to other diseases—in particular dermatitis herpetiformis and severe herpes iris in the beginning of the attack, but later all the symptoms, local and general, became aggravated and death occurred in the third month. There was no history of a wound or abrasion to account for a local infection. The whole subject, obscure as it is as to the origin of the infection, is in some instances worthy of further study, as such cases are met with, and, as the author states, acute septic pemphigus has been recorded in a number of cases possessing a well-defined clinical entity. Some of the post-vaccinal cases (as Howe's), and Bowen's cases, and the Pernet-Bullock type of diseases, come under this head.

Cases of Bromide Eruption Mistaken for Blastomycosis.—O. S. ORMSBY (*Jour. Cutan. Dis.*, October, 1909) narrates three cases in which the diagnosis was difficult. The lesions in all three cases were on the legs and were similar, being pustular and papulopustular. The margins were elevated and crusted, surrounded by bluish-red or pale-red areolæ, in which there were many miliary pustules. In the early stages the bromide eruption is more actively inflammatory, but later the processes in this respect are very much alike, and on a superficial examination the two diseases are clinically counterparts of each other. It is essential in any case suspected to be one of blastomycosis, in which bromides have been administered, to demonstrate positively the presence of the causative organisms (blastomycetes) before making the diagnosis.

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

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Permeability of the Walls of the Intestines.—MEYERHOFER and PRIBRAM (*Ztsch. f. exp. Path. u. Ther.*, 1909, vii, 247) consider the permeability of the intestinal walls from a purely physical point of view, regarding the intestinal wall as a colloidal membrane, and absorption from the intestine as entirely a physical and not a "vital" phenomenon. They have found that the healthy intestinal wall transmits albuminous bodies, ferments, toxins, hemolysins, and antitoxins, but that there is a considerable resistance to their diffusion which prevents transmission for certain periods of time. In the healthy organism this time is more than sufficient for the digestion of albumins, for rendering toxins inert, and to allow the ferments to produce their effects.

If the intestinal walls are inflamed they are much more permeable to crystalloids than those of normal intestines, and colloid substances pass through also much more readily, requiring for passage about one hour instead of from six to twelve hours, as in the healthy intestinal walls. These results were obtained by experimenting with the intestines of very young animals removed immediately after death, and enteritis was produced by feeding, for instance, one of a litter of rabbits on foreign food (cow's milk); another rabbit of the same litter which had been allowed to feed naturally was used as a control. After filling the intestines with various solutions they were suspended in physiological salt solution, which was tested from time to time for the substances contained in the intestines.

The authors believe that this property of inflamed intestinal walls of transmitting various substances much more rapidly than do the healthy intestines, may have a very important bearing on many pathological conditions. The rapid diffusion of foreign albumins may cause a severe disturbance in nutrition; the quick diffusion of ferments may be not indifferent for the organism; the diffusion of toxins and metabolic products in the epidemic diseases associated with enteritis (cholera, typhoid fever, dysentery) may be a factor in the fatality in these diseases; and finally the diffusion of hemolysins produced by intestinal bacteria and parasites may lead to severe anemias, an assumption which has had an eager advocate (Grawitz). The rapid diffusion of antibodies through the inflamed intestines may have a bearing on therapeutics. The authors will report later on the difference between the action of the intestines before and after death. They state, however, that the permeability depends on the relation of the amount of albumin to the water content of the membranes, a relation slow to change in the excised membrane.

Iodine and Exophthalmic Goitre.—TH. KOCKER (*Proc. of 39th Congress of German Surg. Soc., Semaine medicale*, 1910, xxx, 163) draws attention to the effects of iodine upon the body in general and the thyroid gland in particular. Iodine causes a regression of the thyroid gland and a disappearance of goitre, but, on the other hand, symptoms which resemble more closely Basedow's syndrome. The alteration in the blood and characteristic exophthalmus can be produced by large doses of iodine, the symptomatology differing from that of acute iodism. It is a question of iodism of the thyroid gland. The latter stores up iodine and forms with it a compound which will provoke the symptoms of Basedow's disease. Iodine is necessary to the function of the gland, but there are many individuals who are disposed to acquire Basedow's syndrome under the influence of repeated doses of iodine. This predisposition is hereditary or acquired. Many individuals present such symptoms following a simple painting of the skin with iodine.

A Cytoscopic Study of the Cerebrospinal Fluid in General Paresis.—It has been an accepted fact that in all metasyphilitic processes, there occurred a lymphocytosis which has been estimated by counts per cubic millimeter. But STERN (*New York Med. Jour.*, 1910, xci, 909) states this condition is due to degenerated endothelial cells. Undoubtedly, typical lymphocytes do occur, but they are due to a contamination from bleeding into the spinal fluid or blood in the needle during its introduction. The author made a comparative morphological study of both lymphocytes and endothelial cells present in the pleural cavity, and the morphology and degenerative changes in the endothelial cells were the same as in the cells found in the spinal fluid. In no case was he able to find a cell of lymphocytic structure in spinal fluid unless blood contamination was demonstrable either grossly or after centrifugalization. In metasyphilitic diseases, these degenerated endothelial cells were usually present without centrifugalization, while in controls, centrifugalization was necessary to find them. Further study revealed plates as occurs in desquamation and the morphology of the cells was similar. The presence of a subacute leptomeningitis accounts for the desquamation and degeneration and their presence in increased numbers. The previous error he attributes to the low objectives used, $\frac{1}{4}$ and $\frac{1}{8}$ inch, this study having been made with a $\frac{1}{12}$ inch oil immersion. In conclusion, for diagnosis, he feels safe in declaring a case one of general paresis upon the demonstration of a large number of endothelial cells.

Meningococcus Bearers.—S. COSTA (*Comp. rendu. Soc. de biol., Paris*, 1910, lxxviii, 776) in studying the etiology and prophylaxis of epidemic cerebrospinal meningitis, made a careful search for chronic bearers in the associates of six cases under observation. Cultures were made from the nasopharyngeal mucus. Colonies which presented the cultural and morphological characteristics of the meningococcus were then submitted to the agglutination test with anti-meningococcic serum. The first case, an officer, was associated with a bearer in the person of his body servant. For the second, a soldier, out of 18 cultures, 2 bearers were found. They had slept side by side with the patient, under the same blankets, in prison, two nights before his admission to the hospital. Five bearers were found in 26 cultures from the associates of the third case. Out of 24 cultures, but 1 bearer was found in the case of the fourth

patient. Among the 8 bearers in the fifth case, two were neighbors of the patient and one had lost his wife from the disease a month previously. Among the 7 bearers in the sixth case, two were musicians like himself and lived intimately with him.

Experimental Typhoid Fever.—METCHNIKOFF and BESREDKA (*Semaine médicale*, 1910, xxv, 166) have been able to reproduce in a chimpanzee a febrile disease similar to human typhoid fever by feeding the animal fecal material taken from a typhoid patient at the Pasteur Hospital. This fecal material gave a pure culture of *Bacillus typhosus*. Seven days after the beginning of the experiment, the temperature rose to 40.5° but was 38° four days later. At the height, *Bacillus typhosus* was recovered by blood culture. A dysentery followed, to which the animal succumbed on the thirteenth day. The dysenteric stools also yielded the specific bacillus. At autopsy, there were hemorrhagic erosions of the mucous membrane of the large intestine, but in the ileum the Peyer's patches were considerably hypertrophied, corresponding to those in early typhoid fever in man. The retrocecal glands were congested and enlarged, and contained foci of necrosis. In a word, their experience with the chimpanzee shows that the ingestion of fecal material of man rich in typhoid bacilli is capable of producing typhoid fever comparable to the human disease.

Typhoid Bacteriology.—STOKES and STONER (*Jour. Infectious Dis.*, 1910, vii, 457) have collected the statistics of the literature in regard to the bacteriology of typhoid fever. In the urine of 622 typhoid patients during the attack, the cultures were positive in 45 cases, or 7 per cent. These cases were in series reported by Thomas, Hiss, Petruschky, Richardson, Horton-Smith, Blumer, Müller, and Graf. In 744 cases, during convalescence, the bacilli were found in 45 cases, or 6 per cent. Paratyphoid bacilli were recovered from the urine in 4 per cent. of 259 cases during the attack, and 3 per cent. of 92 cases in convalescence. In the stools, the positive cases amounted to only 20 per cent. out of 5844 patients. Twenty-five per cent. of these were present in the second week, 20 per cent. in the third, 16 per cent. in the first, and 10 per cent. in the fourth. Of 703 cases in convalescence, only 2 per cent. were positive. In 954 cases of paratyphoid infection, 5 per cent. of the stools yielded the bacillus during the attack, and 3.5 per cent. of 31 cases in convalescence; 2359 blood cultures yielded the typhoid bacillus in 1625 instances, or 68 per cent. In the first week, the positive cultures were 78 per cent., 69 per cent. in the second, 57 per cent. in the third, 32 per cent. in the fourth, and 25 per cent. after the fourth week. The authors report two instances of isolation of *Bacillus pyocyaneus* from the circulating blood on the fourth day of a typhoid-like attack. They have been able to find only seven other cases in the literature.

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ORIGINAL ARTICLES.

THE THERAPEUTIC ACTION OF DIGITALIS.

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SINCE Withering, in the years 1776 to 1779, by careful observation established the therapeutic powers of digitalis, this drug has formed one of the most valuable weapons which the physician possesses. Withering's directions for its use and his descriptions of its dangers are exceedingly valuable, and have not always been enriched, but rather obscured by much of the work of subsequent observers. An exact pharmacological knowledge has only been obtained, however, by the studies of the past few years, and one of the reasons for this has been the lack of an exact physiological knowledge of the action of the heart.

The cardiac muscular mass maintains, when furnished with proper supplies of salts, oxygen, and foodstuffs, an automatic activity. Each cell, and hence the whole mass, may be considered as possessing the following physiological properties: irritability, contractivity, rhythmicity, conductivity, and tone. The functioning of the whole heart may be influenced either by the cardiac centre, through the vagus and sympathetic nerves, or by chemical changes occurring in the heart muscle. The vagus nerve carries fibers, which, when stimulated, may depress each and all of the physiological properties referred to above; the most evident fact is the decrease in rhythm and contractivity. Drug stuffs may introduce such chemical changes in the muscle cell that any one of these properties is affected alone, or several of them at the same time, but not necessarily to the same

extent nor in like manner. For example, in a certain stage of the action of choral upon the heart muscle, its rhythm alone is decreased; its other properties are apparently unaltered. Camphor promptly overcomes this depression and restores the rhythm. Digitalis has a much more complex action. First, it has a very marked stimulant action on the cardio-inhibitory centre and on vagus nerve endings in the heart, and consequently decreases rhythm. Roughly, the higher the rate above normal, the greater this effect is, while if the rate is normal the effect is very slight and even absent. The next most important action seems to be upon the tone and contractivity of the heart muscle acting on its cells directly. The contractivity is increased and more blood, in consequence, expelled at each beat. Its tone is also increased, and hence a decrease in the volume of the cavity of the heart, and decrease of dilatation, if this exists. These two properties also undergo little or no change with therapeutic doses if the heart muscle is normal, while the change is very marked if the heart is dilated. Conductivity is depressed. This is important, for often the first sign of the cumulative action of the drug is due to this fact, and is manifested in the slow ventricular rhythm, while the auricle continues to beat more rapidly (heart block). The action upon the vessels is primarily to increase their tone, and hence increase the blood pressure. This action, however, appears to be slight in therapeutic doses. More recent studies have shown that it tends to dilate the coronary vessels and those of the kidney (Löwy). That we are able to make such a precise statement of the pharmacological action of digitalis is due to the physiological work of Baskell, extended by Engelmann, Langendorff, Hering, Bock, and others, and the pharmacological work of Williams, O. Frank, Gottlieb and Magnus,¹ and Böhme.²

The studies of Schmiedeberg, Kiliani, Homolle, Nativelle, and Cloetta have shown us that digitalis contains probably more than one glucoside, and that these glucosides are not stable and are exceedingly difficult to isolate. Such a series of experiments as those of Haynes³ has forced us to recognize that the active principles are present in very varying amounts in the crude drug when gathered at different times and in different localities, and as a result in the galenical preparations made from them. Hence the necessity for pharmacological standardization.

The work of Fraser,⁴ Feist, and Thoms⁵ has shown that strophanthus contains an active principle which is similar in its action to digitalis, and differs from it only in being more irritant and somewhat more rapid in its action. This fact has become of great importance since Fraser succeeded in isolating from *Strophanthus kombé*, an

¹ Arch. f. exp. Path. u. Pharm. 1905, li, 30.

² Ibid., lii, 346.

³ Biochem. Jour., 1906, i.

⁴ Trans. Royal Soc., Edinburgh, 1890.

⁵ Pharm. Zeit., lii, 699, cited in the Jahresbericht d. Pharm., 1907, 42.

amorphous glucoside whose isolation is easy and which may be readily obtained pure. Thoms has succeeded in isolating from *Strophanthus gratus* a crystalline glucoside which has similar advantages.

It was on account of the ease with which a pure strophanthin of known pharmacological activity could be obtained that Fraenkel⁶ selected this representative of the digitalis group for intravenous administration. The advantages that he obtained by intravenous injection were, first, the great decrease in time between administration and evident pharmacological action. Strophanthin given per os usually does not act for at least seventeen hours; digitalis often not for thirty-six hours. Subcutaneously strophanthin in just toxic doses acts in four or five hours when administered to a rabbit, while digitalinum requires twenty-four hours or more. Intravenously the action is fully established in thirty to sixty minutes. Secondly, the certainty of absorption; both strophanthin and the glucosides of digitalis are irritant and slowly absorbed in the intestines; there is, in consequence, great danger of irritating the stomach, of increased peristalsis, and in consequence a loss of a varying amount of the dose administered. Owing to the irritant nature of these glucosides, administration per os is often contra-indicated. This property also makes their subcutaneous administration painful; the pain, except the skin prick, when administered intravenously, is, of course, absent. Thirdly, in many cases a single injection will produce as much benefit as a week's treatment with digitalis per os. As in the two cases reported below, a single injection was sufficient completely to restore broken cardiac compensation. The method had this further advantage; that one can tell in an hour or two whether digitalis will aid the case or not; and if it fails, one can try some other procedure without the long wait entailed if administration per os be adopted.

The first case which I report illustrates these points very well:

CASE I.—J. McB., aged sixty-five years, has led a worrying life; generally in good health until three years ago, since when he has had several attacks of cardiac weakness. The present attack began about six weeks ago, but has been much worse during the past week, so that the patient has been confined to bed. Status presens: Patient robust, muscular; arteries somewhat sclerosed; pulse, 140 (?); at apex 160 beats were counted, irregular, weak; blood pressure, 160 cm. of water; diastolic pressure, 120 (the measurements were made with a von Recklinghausen sphygmomanometer). Cardiac dullness from one-half inch to the right of the sternum to the mid-axillary line. Area of pulsation from one-half inch internal of the mammary line to the midaxillary line in the fourth, fifth, and sixth interspaces. Marked liver pulsation. Liver one inch below the sternum, one and one-half inches below the right costal margin in

⁶ Arch. f. exp. Path. u. Pharm. 1904, li, 84; Therap. Monatssch., 1909, xxiii, 109; Arch. f. exp. Path. u. Pharm. 1907, lvii, 79; 1908; Suppl. Bd., 88.

the mammary line. Some œdema about the ankles. The quantity of urine has been failing, and up to the time of examination, 8 P.M., only two or three ounces has been passed since the preceding evening. Cheyne-Stokes respiration of the following type:

	Pulse.	Systolic pressure.	Diastolic pressure.	Difference.	Work.
December 12, 8.35 P.M.	166	160	120	40	6640
1 mg. of strophanthin intravenously.					
December 12, 8.55 P.M.	150	174	132	42	6300
December 12, 9.30 P.M.	66	180	110	70	4620
December 12, 9.45 P.M.	64	190	100	90	5760
December 12, 11.00 P.M.	60	180	100	80	4800
December 13, 6.00 P.M.	64	188	105	83	5312
December 19	64	185	103	82	5284

At 8.55 the amplitude of the pulse, both felt with the finger and as observed in the swinging of the sphygmomanometer needle, seemed better. At 9.45 several ounces of urine was passed, and urine was passed again at eleven o'clock. On the following day the liver pulsation was absent, though the liver was still palpable and about one-half inch below the right costal margin. The area of cardiac pulsation and dulness was slightly less than it had been. The Cheyne-Stokes respiration had completely disappeared. Beyond rest in bed no other treatment of importance was adopted. A subsequent attack, which came on some months later, was relieved in the same manner.

CASE II.—Female, aged twenty-three years. Has a severe mitral insufficiency, and has suffered on several occasions from broken compensation. The use of digitalis has in all cases been sufficient to restore the compensation in about a week. After some undue exertion the present attack occurred. During the past two days less than eight hundred cubic centimeters of water has been passed, and signs of oncoming œdema are quite manifest about the ankles. When seen on April 30, 1909, there was slight dyspnoea, and the following pressures were noted:

	Pulse.	Systolic pressure.	Diastolic pressure.	Difference.	Work.
April 30, 1909, 4.00 P.M.	132	156	116	40	5280
April 30, 1909, 4.15 P.M.	180	180	114	66	7128
April 30, 1909, 4.45 P.M.	90	176	116	60	5400
April 30, 1909, 6.10 P.M.	88	180	116	64	5632
May 1, 1909, 3.40 P.M.	80	178	112	66	5280

During the twenty-four hours ending on the morning of May 1, four thousand cubic centimeters of urine was passed, and on the subsequent days about fifteen hundred. Rest in bed was sufficient to bring about a restored compensation.

It is hardly necessary to repeat what is well known in regard to the indications for the use of digitalis or of strophanthin as its substitute. It might, however, be of value to point out some of the

cases in which a failure to obtain a successful result will be observed. Fraenkel has drawn attention to the fact that a successful use cannot be expected when the cause of the œdema or ascites is entirely due to a kidney trouble, but that digitalis can only aid in these cases when there is a failure of circulation due to secondary cardiac failure. In sepsis or in acute pneumonia, when the intoxication has already become intense, and the pulse has become very rapid and weak, strophanthin has no effect in decreasing the rate or in strengthening the beat.

CASE III.—Mrs. E., aged 45 years. A severe lobar pneumonia, affecting both lungs, with high fever and every sign of marked intoxication; gave premature birth to a child of seven months. At the time of the administration of strophanthin, she had a weak, rapid pulse, which could not be counted at the wrist, but was at least 180 at the apex. Venesection had failed to give relief. No improvement in either rate or force of the heart beat could be observed.

In a case of sepsis supervening after pregnancy, and in a case of septicemia in a child of eleven, equally unsuccessful results were obtained. I might note in passing that many of the clinicians who use digitalis in pneumonia resort to its administration at an early stage of the disease, and von Jaksch⁷ advises its use in sepsis as soon as the increase in cardiac rate is observed.

An experiment on a dog which contracted pleuropneumonia while in the laboratory gave an opportunity to repeat the clinical experiments under more favorable conditions. The dog was given morphine, and then pithed; artificial respiration was then undertaken; the chest was opened, cannulæ placed in carotid and jugular, and the ventricle attached to a myograph. Rate, 120; mean pressure, 80; 1 mg. strophanthin intravenously had no effect during the succeeding thirty minutes. The blood pressure fell to 70. The vagi were stimulated, but a strong current was needed to produce any effect. Vagus arrest was not obtained with the current available, and the deduction was made that the vagus effect on the heart was not normal. Further experiments of this type will be carried out in the near future.

I feel that Fraenkel's method of intravenous administration of strophanthin puts into the hands of the physician a very valuable means of overcoming cardiac weakness promptly, and, in consequence, must prove a very great boon. The mode of application is so certain, its effect so striking, that it might almost awake a suspicion that such drastic action might damage the heart. It might be felt that, in order to maintain the circulation when the cardiac rate is so suddenly decreased, a very great increase of work must be done by the heart. This is certainly true for each individual

⁷ *Therap. Monatssch.*, 1909, xxiii, 78.

beat, but if one takes the total amount of work done during a unit of time, this is by no means necessarily the case. If one admits that von Recklinghausen⁸ is correct in judging the relative amount of work done by the heart by the product of the difference between diastolic and systolic pressure and the rate per minute, the two cases quoted above indicate two of the different results which may be seen. It will be noticed that in the fifth column the product of the difference and the pulse rate is given, and that in the first case a definite decrease in the work done is shown, while in the second case there is at first an apparent rise, though the work finally is by chance identical with that performed by the heart before treatment. We must, however, remember that even if the heart is doing a greater amount of work in each interval of time, we have increased its ability to do work owing to the increase in the contractibility of the muscle cells, and have also decreased the danger of cardiac failure by increasing the tone of the heart muscle. We have also probably improved the nutrient conditions of the muscle, as digitalis increases the flow through the coronary vessels.

Attention might perhaps be drawn to the results obtained by Pohl⁹ and Löwy.¹⁰ The latter showed that if digitalis be given in combination with acid, the glucosides quickly decrease in activity. This is, of course, a well-known type of chemical incompatibility. Pohl has, however, called attention to the danger of pharmacological incompatibility, and has shown that the combination of quinine with digitalis decreases the latter's cardiac action. The same seems to be true of potassium salts and of caffeine, while alcohol, chloroform, and liquor ammoniæ anisatus aids its action. Morphine and codeine seem to decrease the rate of absorption, and hence decrease the effectiveness of the drug stuff.

DIGESTIVE OR ALIMENTARY HYPERSECRETION OF GASTRIC JUICE.¹

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DIGESTIVE or alimentary hypersecretion is a condition in which abnormally large amounts of gastric secretion are obtained after the introduction of an ordinary test meal, although the fasting stomach contains but a few cubic centimeters of juice. The latter

⁸ Arch. f. exp. Path. u. Pharm., 1906, Iv, 375, 412.

⁹ Therap. Monatsschr., 1909, xxiii, 110.

¹⁰ Wien. klin. Woch., 1906, No. 39.

¹ Read at a meeting of the Association of American Physicians, Washington, D. C., May 4, 1910.

finding distinguishes this condition from continuous hypersecretion. This disorder was first described by Straus,² who pointed out that in some forms of hyperacidity relatively large quantities of a thin, watery, gastric secretion were obtained one hour after a test breakfast. He attributed this condition to the disturbance of the starch digestion on the ground that the undissolved starch acted as a stimulant to the further secretion of hydrochloric acid. Zweig and Calvo³ investigated this condition more fully. They employed the Sahli test meal as a means of distinguishing it from other conditions and designated it "Alimentary Hypersecretion." They differentiated alimentary hypersecretion from the larval hyperacidity described by Straus and by Schüler⁴ characterized by the following symptoms: (1) The formation of amidulin; (2) an increased amount of stomach contents; (3) a lowered specific gravity; and (4) a lowering of the freezing point.

The typical symptoms of hyperacidity are present in larval hyperacidity, and yet the contents removed after the test breakfast reveal a normal percentage of free acid. Straus and Schüler assume that in these cases there is actually a hyperacidity, which is not revealed because the examination of the gastric contents is made an hour after the test breakfast has been taken. It is possible that the increased quantity of acid secreted at first (*secretio celer et magna*) is soon neutralized by the so-called diluting secretion, so that the amount of acid in the test breakfast is found to be normal or subnormal. Elsner⁵ working under the direction of Boas, again called attention to this condition, and Boas⁶ more recently investigated this question and considers the term digestive gastrosuccorrhœa more appropriate than alimentary gastrosuccorrhœa. This particular form of increased gastric secretion is dependent upon the act of digestion, in contradistinction to continuous hypersecretion in which the secretion extends beyond the digestive act, and in which considerable amounts of gastric juice are found in the fasting stomach. All of the twelve cases reported by Boas occurred in males; the disease is found in youth as well as in old age. An important symptom is the extreme emaciation, a loss of from ten to fifteen pounds in weight being a rather usual occurrence. This loss of flesh is a most important sign, especially since it appears without the slightest tendency to disturbance of motility of the stomach. The appetite and quantity of food consumed may be normal; occasionally, however, both may be decreased. The great loss in weight must depend upon the loss of gastric secretion. Amylolysis is greatly diminished and constipation is very marked. The subjective signs are of much the same character as those found in nervous dyspepsia. Patients complain of various sensations in the stomach, pressure, fulness, eructations,

² Deut. Archiv f. klin. Med., lvi, 120.

³ Münch. med. Woch., 1898.

⁶ Deut. med. Woch., 1907, 135.

³ Archiv. f. Verdauungskr., 1903, ix, 262.

⁵ Berl. klin. Woch., 1904, 670.

excessive flow of saliva; occasionally of violent pains; very rarely, if ever, heartburn; often acid eructations. Nausea or vomiting rarely occurs. Nervous symptoms are usually present, as headaches, insomnia, etc. A marked splashing sound is observed in the region of the stomach; tender spots, painful to pressure, are not observed; the abdomen is occasionally distended with gas. A diminution in the chlorides and an increase in indican are frequently observed in the urine. This disease is much like atony, and Boas believes that there can be no question that it has in many instances been mistaken for atony or nervous dyspepsia. In order to determine the presence of this condition, Boas advises a dry test meal. As bread contains 35.5 per cent. of water, he utilizes Albert cakes, containing but 8.9 per cent. of water. If five Albert cakes are given as a test meal and removed from the stomach at the end of an hour, but a small residue will be recovered under normal conditions. In digestive gastrosuccorrhœa, however, 100 to 200 c.c. of fluid may be obtained. On standing, it forms into two layers, a lower layer slight in amount precipitated to the bottom, and above a clear or slightly cloudy fluid, three or four times as large in amount. On examination the secretion generally shows a total acidity and a percentage of free hydrochloric acid not above and often below normal. Boas found in a large proportion of cases a total acidity of from 40 to 56, and free hydrochloric acid 35 to 45, which indicates that while in this condition there may be no excess in the acid of the gastric secretion, the secretion is greatly increased in quantity. In other words, there is a hypersecretion, but no hyperacidity. The average specific gravity of the gastric juice is 1012. The secretion presents a more or less marked biuret and sugar reaction, while albumin is not present; erythrodextrin, amidulin, and also the amylum reactions are usually marked. By means of the dry diet the diagnosis is made positive. If the bottom layer of the secretion is large, there must be a motor disturbance present at the same time. Boas also investigated the contents of the stomach in the fasting state, and pointed out three distinct types of digestive hypersecretion:

1. A form in which the motor function of the stomach is normal and in which no contents are obtained from the fasting stomach.
2. A type in which more or less acid gastric juice is obtained from the fasting stomach, such as is observed in permanent gastrosuccorrhœa.
3. A type in which the motor function of the stomach is markedly disturbed at the same time.

The symptoms do not point definitely to the condition; the most marked are those of chronic nervous dyspepsia with marked emaciation, succussion in the region of the stomach a considerable length of time after meals, and even after small meals. The symptoms often point to atony; therefore, in order to arrive at an exact diagnosis three forms of examination must be used: (1) Examination of the

fasting stomach; (2) examination of the gastric contents one hour after the dry test meal; and (3) examination of the gastric contents one hour after a test breakfast.

Zweig⁷ has recently again reported his observations in this condition. He attributes the most prominent symptoms of the disorder, loss of flesh, not to the loss of gastric juice, as pointed out by Boas, but to the fear of eating due to the great discomfort produced by the ingestion of food. He also calls attention to the marked constipation attendant upon this disorder, and also to the fact of the great variability of symptoms, the best of health being enjoyed for weeks, to be followed by days of marked discomfort due often to psychic influences, such as sorrow, excitement, etc. A very frequent symptom is the splashing sound produced over the area of the stomach, which is often considered a sign of atony of the stomach. This sound is really devoid of any diagnostic value regarding this condition. It should, however, attract attention at once to the possibility of a digestive gastrosuccorrhœa. Zweig investigated eighteen cases, employing the Sahli method; in the remainder of his cases he utilized the Ewald-Boas test breakfast. He found that under normal conditions the amount of solid sediment is from 40 to 60 per cent. of the total sediment, while in alimentary hypersecretion the amount of solid sediment is always under 30 per cent., while the fluid contents amounts to from 70 to 93 per cent. Zweig also points out that even in those cases in which the total amount of gastric contents is not increased, but in which these relations of the solids to the liquid exist, an alimentary hypersecretion must be assumed. In his investigations, Zweig placed the gastric contents into test-tubes, graduated in cubic centimeters, 20 cm. in length and 3 cm. in diameter; these were centrifugalized and the amount of sediment determined. If the entire quantity of solid sediment after a test breakfast is over 77 c.c., Zweig considers that the alimentary hypersecretion is accompanied by a motor insufficiency. In his 18 cases, 10 presented hyperacidity, 2 subacidity, and 6 normal acidity. The specific gravity is always reduced; instead of the normal 1015 to 1020, the values are reduced to 1007 to 1012.

The disturbance of starch digestion depends on the degree of hyperacidity. In all cases accompanied by a marked hyperacidity a disturbance of amylolysis with the production of amidulin is observed. In one case of subacidity achroödextrin was present; in all other cases erythrodextrin was produced. In two cases he noted the passage of an alimentary hypersecretion into a continuous gastrosuccorrhœa. In his 18 cases, but 4 were observed in females; 14 in males.

My own observations extend over a series of 14 cases. Of these, there are 12 males and 2 females. The ages vary between eighteen

⁷ Archiv f. Verdauungskrr., 1907, xiii, 143.

and sixty-four years. The symptoms are largely those of gastric neurasthenia, consisting of fulness, pressure, distention, cructations, and pains in the region of the stomach, together with occasional attacks of nausea and vomiting, rarely of heartburn, and usually with extreme constipation. In all cases general nervous symptoms are manifested, as lassitude, headache, insomnia, irritability, and depression. A marked feature of the cases is the variability of symptoms: periods of discomfort alternating with unaccountable periods of well being; the periods of discomfort apparently often being induced by nervous influences, such as shock or anxiety. A symptom present in all instances is the emaciation; a loss of weight of from fifteen to thirty-two pounds was observed in my cases. This is especially striking, as the appetite and amount of nourishment consumed were not abnormally diminished in any instance. Localized areas tender to pressure were observed in only two cases, but were inconstant. A marked succussion sound was detected in all cases long after meals, and even after small meals. Three of the cases were complicated with an enteroptosis; in none was the stomach dilated. The following examinations were made in all instances: (1) Extraction and examination of the gastric contents one hour after taking an Ewald-Boas test breakfast; (2) an examination of the gastric contents made one hour after taking a dry test breakfast; and (3) an attempt was made to extract and examine the contents from the fasting stomach.

At least three examinations were made in all instances, the average results obtained from each individual being recorded in the tables.

1. *Gastric Contents Extracted after an Ewald-Boas Test Breakfast.* The quantity of contents obtained was always very large, varying between 190 c.c. and 410 c.c. This is always a most striking feature of this condition, and should alone point to the possibility of the existence of an alimentary gastrosuccorrhœa. The appearance of the contents was also characteristic, for the most part a very watery secretion with but little sediment. On standing, two layers were formed, a lower layer of solid sediment very slight in amount, and above an almost clear fluid layer very much larger in quantity. After centrifugalization the amount of solid sediment in proportion to the total sediment was constantly under 32 per cent., and even as low as 6 per cent., while the fluid ranged as high as 94 per cent., and was but once as low as 68 per cent. Under normal conditions the proportion of solid to the total sediment varies between 40 and 60 per cent.; this variation, therefore, from the normal, presents another very significant sign of digestive gastrosuccorrhœa. The specific gravity of the gastric contents varied between 1005 and 1014, being reduced from the normal values 1015 and 1020. In my 14 cases, 8 presented hyperacidity, 5 normal acidity, and 1 sub-acidity. In the hyperacidity cases the total acidity ranged between 94 and 70; free hydrochloric acid between 74 and 44; in the normal

cases, the total acidity varied between 64 and 42; free HCl, between 42 and 32; in the subacidity case the total acidity was 28; free HCl, 10. The starch digestion depends largely on the degree of acidity. In the hyperacidity cases there was a marked interference with the amyolysis with the formation of amidulin. In the cases with a normal percentage of acid, erythroextrin was formed; while in the subacidity case, achroöextrin was obtained.

2. *Gastric Contents Extracted After a Dry Test Breakfast.* Inasmuch as wheat bread contains about 35.5 per cent. of water, the ordinary soda crackers, containing but 6 to 7 per cent. of water, were utilized in place of bread. The contents of the stomach was expressed at the end of one hour. In normal individuals little (5 to 15 c.c.) or no gastric contents can be obtained under these conditions. In my cases of alimentary hypersecretion from 104 c.c. to 220 c.c. of secretion was obtained without difficulty. The secretion expressed was of a very thin watery appearance with but a small amount of solid residue. On standing, it formed into two layers, a lower small layer of solid residue and an upper and larger almost clear fluid layer. On centrifugalizing, the amount of solid sediment in proportion to the total sediment was constantly under 22 per cent., and even as low as 6 per cent., while the fluid residue was as high as 94 per cent. and never below 78 per cent. The specific gravity of the gastric contents varies between 1005 and 1014. With the dry test meal two of my cases presented hyperacidity, four normal acidity, and one subacidity. In the hyperacidity cases the total acidity varied between 85 and 80, the free hydrochloric acid between 68 and 72. In the normal cases the total acidity ranged between 40 and 58, the free hydrochloric acid between 34 and 46; and in the subacidity case the total acidity was 20; free hydrochloric acid, 5. In the hyperacidity cases there was a formation of amidulin; in the cases with a normal percentage of acid, erythroextrin; in the subacidity case, achroöextrin.

3. *Extraction of Contents from the Fasting Stomach.* This procedure was attempted in all instances. In not one of our cases could more than 10 to 15 c.c. of contents be obtained.

The combination of an alimentary hypersecretion with a continuous gastrosuccorrhœa was, however, twice noted by Zweig. Alimentary gastrosuccorrhœa is a gastric affection of nervous origin, which is apt to extend over a long period of time, presenting great variability of symptoms, and with days and weeks of apparent perfect health giving place suddenly to periods of severe distress. That this disorder is purely a form of gastric neurasthenia is manifested by the fact that when the patient is restored to good health the increased secretion is apt to disappear. This condition occurred in two of my cases (Cases VII and X), in which after an Ewald-Boas test breakfast the quantity of gastric secretion was reduced to from 30 to 50 c.c., and with a dry meal no secretion could be obtained for

a short period of time. On the other hand, Zweig has shown that this affection may pass over into a condition of continuous gastro-succorrhoea if improperly treated. The treatment is largely the treatment of nervous dyspepsia. As most patients have lost much flesh and strength, the best results are obtained by means of the rest cure. In five of my cases in which this form of treatment was undertaken, excellent results were obtained. Ordinarily the diet should consist of three meals a day, as all food ingested has a tendency to increase the gastric secretion. The nourishment should contain an excess of proteins and fats and a small proportion of carbohydrates. Of the proteins, milk, eggs, and fish are to be preferred, as they do not tend to increase the gastric secretion as much as meat. Fats decrease the acid of the gastric secretion and are therefore highly recommended; they should be given as butter, cheese, cream, and olive oil. The carbohydrates should only be allowed in the most digestible forms, as vegetables in purée form, dextrinized flour, and stale bread and toast. The quantity of fluids ingested need not be decreased in this affection. Large quantities of milk and alkaline waters may be taken with benefit. Such food as bouillon, meat extracts, coffee, tea, and alcohol, as well as all acid and spiced foods, should be avoided. The alkalies with or without belladonna or its preparations are often serviceable in the treatment of this disorder. It is needless to point out that such measures as hydropathic procedures, massage, etc., which have a tendency to build up and strengthen the nervous system, are of great service in the treatment of this affection.

TABLE OF CASES PRESENTING THE RESULTS OF THE EXAMINATION OF GASTRIC CONTENTS FOLLOWING AN EWALD-BOAS TEST BREAKFAST.

No.	Name.	Age.	Sex.	Entire quantity expressed.	Total acidity.	Free HCl.	Specific gravity.	Microscopic findings.	Remains per cent.		Amylolysis.
									Solid.	Fluid.	
1	A. F.	23	M	220	64	42	1005	Normal	28	72	Erythrodextrin
2	T. K.	34	M	190	78	64	1008	"	6	94	Amidulin
3	L. S.	42	M	234	88	70	1009	"	14	86	"
4	O. M.	18	M	410	62	46	1012	"	18	82	Erythrodextrin
5	T. P.	47	M	218	82	70	1007	"	12	88	Amidulin
6	F. J.	28	F	298	94	72	1008	"	24	76	"
7	H. N.	53	M	212	60	46	1012	"	26	74	Erythrodextrin
8	J. J.	64	M	325	86	74	1014	"	32	68	Amidulin
9	M. F.	50	M	244	76	62	1006	"	25	75	"
10	K. E.	48	M	350	42	36	1012	Yeast spores	14	86	Erythrodextrin
11	J. S.	59	M	240	74	60	1011	Normal	12	88	Amidulin
12	T. M.	34	F	334	28	10	1007	"	26	74	Achroödextrin
13	S. C.	45	M	248	54	32	1014	"	25	75	Erythrodextrin
14	J. D.	29	M	224	70	44	1008	"	19	71	Amidulin

TABLE OF CASES PRESENTING THE RESULTS OF THE EXAMINATION OF GASTRIC CONTENTS FOLLOWING A DRY TEST BREAKFAST.

No.	Name.	Age.	Sex.	Entire quantity expressed.	Total acidity.	Free HCl.	Specific gravity.	Microscopic findings.	Remains per cent.		Amylolysis.
									Solid.	Fluid	
1	A. F.	23	M	110	45	36	1008	Normal	18	82	Erythrodextrin
2	T. K.	34	M	104	52	44	1005	"	6	94	"
3	L. S.	42	M	123	46	38	1012	"	10	90	"
4	O. M.	18	M	220	42	34	1014	"	12	88	"
5	T. P.	47	M	105	80	72	1006	"	22	78	Amidulin
6	F. J.	28	F	130	85	68	1009	"	20	80	"
7	H. N.	53	M	125	52	44	1014	"	14	86	Erythrodextrin
8	J. J.	64	M	182	58	46	1013	"	16	84	"
9	M. F.	50	M	115	48	38	1009	"	12	88	"
10	K. E.	48	M	125	40	36	1012	Yeast spores	20	80	"
11	J. S.	59	M	154	55	44	1008	Normal	18	82	"
12	T. M.	34	F	205	20	5	1006	"	16	84	Achroödextrin
13	S. C.	45	M	195	44	36	1012	"	14	86	Erythrodextrin
14	J. D.	29	M	184	55	42	1010	"	20	80	"

ABSTRACT OF CASE-HISTORIES.

CASE I.—A. F., male, aged twenty-three years, has been suffering with nervousness and gastric disturbance for six years; there were periods of from three to six months in which all discomforts would subside, and the patient would feel perfectly well until the onset of another attack. The patient complains of nervousness, irritability, insomnia, and headaches, together with occasional attacks of nausea, though never of vomiting, but of distention and flatulency, and of pain in the stomach. He has lost eighteen pounds in weight in the last three months. On examination the patient is found to be sallow and anemic in appearance; nothing abnormal is detected on examination of the abdomen. The gastric contents after an Ewald test breakfast is large, averaging 220 c.c., with a total acidity of 64; free HCl, 0.15 per cent., of a specific gravity of 1005; on centrifugalizing, the proportion of solid to fluid sediment is as 28 to 72; erythrodextrin reaction marked. After a dry test meal of five crackers, the amount of gastric secretion removed averages 110 c.c. in quantity, with a total acidity of 45; free HCl, 0.13 per cent., of a specific gravity of 1008; the proportion of solid to fluid sediment is as 18 to 82; marked erythrodextrin reaction. Under a rest cure the patient gradually improved in health, and was free of all distress at the end of ten weeks.

CASE II.—T. K., male, aged thirty-four years, complains of gastric distress for over three years prior to this period; he had had a nervous breakdown, which prevented him from following his regular occupation for six months. The symptoms now are entirely gastrointestinal in character; they consist of distention and fulness after meals, occasionally of pain, of eructations, and of marked consti-

pation. At times the patient feels quite well for a short period of time, when any undue exertion, emotion, or error in diet will induce a similar attack. He believes that business worry is the direct cause of the present attack. The patient has lost twenty-five pounds in weight. On physical examination nothing abnormal can be detected in the patient's condition. The gastric contents removed after an Ewald test breakfast was large in quantity, amounting to 190 c.c.; total acidity, 78; free HCl, 0.23 per cent.; specific gravity, 1008; the proportion of the solid to the fluid sediment being as 6 to 94; amidulin reaction present. After a dry test meal the gastric contents removed averages 104 c.c.; total acidity, 52; free HCl, 44; specific gravity, 1005; erythrodextrin reaction marked. The patient did well under careful dietetic regulations given him, and continued to improve during the next three months, but he has drifted away from my observation, and the final effect of the treatment cannot be stated.

CASE III.—L. S., male, aged forty-two years, has been suffering with his present gastro-intestinal disturbance for the last nine months, though he had had similar attacks three and five years previously. His present symptoms are composed of distention and fulness after meals, nausea, and occasionally vomiting and pain in the stomach; the patient complains of great irritability, nervousness, headaches, and insomnia; he has lost sixteen pounds in weight in the last nine months. Upon examination, nothing abnormal is revealed, except a rather marked splashing in the region of the stomach. After an Ewald test breakfast, the amount of gastric contents averages 234 c.c. in amount; with a total acidity of 88; free HCl, 25 per cent.; specific gravity of contents, 1009; the proportion of solid to fluid contents being as 14 to 86; amidulin reaction marked; after a dry test meal the quantity of contents expressed amounted to 123 c.c., with a total acidity of 46; free HCl, 0.13 per cent.; specific gravity, 1012; the proportion of solid to liquid sediment being as 10 to 90; erythrodextrin reaction marked. Under the influence of a carefully regulated diet, proper exercise, and the use of belladonna, the patient gradually recovered his health and the gastric symptoms disappeared.

CASE IV.—O. M., male, aged eighteen years, has had more or less stomach disturbance all his life, with periods of entire relief extending over six to eight months. The symptoms mainly complained of are eructations, nausea, and fulness after meals, together with great nervousness. The patient has lost eighteen pounds in weight. On physical examination nothing abnormal can be detected. The entire quantity of gastric juice removed amounted to 410 c.c., with a total acidity of 62; free HCl, 0.16 per cent.; specific gravity, 1012; the proportion of solid to fluid sediment being as 18 to 82; erythrodextrin reaction. After the dry test meal the amount of contents removed is 220 c.c., with a total acidity of 42; free HCl, 0.15 per cent.; specific gravity, 1014; proportion of solid to liquid

contents, 12 to 88; erythrodextrin reaction marked. Under a partial rest cure and the use of belladonna with nux vomica, the patient was gradually relieved of his symptoms.

CASE V.—T. P., male, aged forty-seven years, after an intense shock was suddenly overtaken with nervousness and gastric distress; there was present marked depression, insomnia, nausea, and vomiting of large quantities of fluid immediately following the meals, and a loss of appetite. He has been suffering three months, and has already lost twenty-five pounds in weight. Physical examination reveals nothing abnormal; after an Ewald test breakfast the quantity of gastric contents averaged 218 c.c., with a total acidity of 80; free HCl, 0.26 per cent.; specific gravity, 1006; proportion of solid to liquid contents, 22 to 78; amidulin reaction present. The patient was entirely relieved of his symptoms by a sojourn at the seashore combined with dietetic and hydropathic treatment.

CASE VI.—F. J., female, aged twenty-eight years, has been complaining with indigestion and nervousness for over eight years; at times she would be quite well and free of all distress, when without cause another attack would manifest itself. The attacks last from two to three months, and are characterized by a feeling of exhaustion and nervousness, pressure and fulness in the stomach after meals, and extreme constipation. The patient has lost thirty-two pounds in weight. On physical examination a marked enteroptosis is detected, together with a succussion sound in the region of the stomach. After an Ewald test breakfast the quantity of secretion obtained was 298 c.c., with a total acidity of 94; free HCl, 0.26 per cent.; specific gravity, 1008; proportion of solid to liquid sediment, 24 to 76; amidulin reaction present. After a dry test meal 130 c.c. of contents was obtained, with a total acidity of 85; free HCl, 0.25 per cent.; specific gravity, 1009; proportion of solid to liquid sediment, 20 to 80. The usual dietetic and hydropathic treatments were undertaken in this case; the patient was, however, not relieved of her discomfort.

CASE VII.—H. N., male, aged fifty-three years, had been complaining of discomfort in his stomach for the last fifteen years. The disturbances were not always equally severe, and would disappear for months at a time during this period. On physical examination the patient is found very thin; a marked splashing sound can easily be elicited in the region of the stomach. There is marked enteroptosis present; otherwise nothing abnormal is detected. After an Ewald test breakfast 212 c.c. of contents was removed, with a total acidity of 60; free HCl, 0.16 per cent.; specific gravity, 1012; proportion of solid to liquid sediment, 26 to 74; erythrodextrin reaction marked. After a dry test meal, an average of 125 c.c. of contents was obtained, with a total acidity of 52; free HCl, 0.16 per cent.; specific gravity, 1014; proportion of solid to liquid sediment, 14 to 86; erythrodextrin reaction marked. After a rest cure of six

weeks the patient recovered his health entirely and was completely free from all discomfort. An Ewald test breakfast was given at this time; the quantity of contents obtained was but 30 c.c., with a total acidity of 40; free HCl, 0.12 per cent.; after a dry test meal no secretion could be obtained.

CASE VIII.—J. J., male, aged sixty-four years, has been complaining of nausea and vomiting for a year and a half; the vomiting of large quantities immediately after meals has been especially noted by the patient. He has lost twenty-eight pounds in flesh during this time. On physical examination nothing abnormal can be detected. After an Ewald test breakfast 325 c.c. of contents was removed, of a total acidity of 86; free HCl, 0.27 per cent.; specific gravity, 1014; total solid to liquid sediment, 32 to 68; amidulin reaction marked. After a dry test meal an average of 182 c.c. of gastric contents was obtained, with a total acidity of 58; free HCl, 0.17 per cent.; specific gravity, 1013; proportion of solid to liquid sediment, 16 to 84. The patient was dieted and given belladonna and the alkalies, and was somewhat relieved of his discomfort.

CASE IX.—M. F., male, aged fifty years, has been suffering with a digestive disturbance accompanied with nervousness for over five years; during none of this time has the patient been able to partake of a general diet, being forced to limit himself to but a very few articles of food; if a liberal diet was indulged in he would become nauseated, have fulness and distention in the region of the stomach, suffer with eructations, and occasionally with heartburn, with headaches and depression. The patient is always extremely constipated; he has lost fifteen pounds in weight. On physical examination nothing abnormal can be detected. After an Ewald test breakfast an average of 244 c.c. of gastric contents was obtained, with a total acidity of 76; free HCl, 0.22 per cent.; specific gravity, 1006; proportion of solid to liquid sediment, 25 to 75; amidulin reaction marked. After a dry test meal, 115 c.c. of contents was obtained; total acidity, 48; free HCl, 0.13 per cent.; specific gravity, 1009; proportion of solid to liquid sediment, 25 to 75; amidulin reaction marked. After a dry test meal 115 c.c. of contents was obtained; total acidity, 48; free HCl, 0.13 per cent.; specific gravity, 1009; proportion of solid to liquid sediment, 12 to 88; erythrodextrin reaction marked. A rest cure of eight weeks was undertaken; the patient gained forty pounds in weight and was entirely relieved of all of his discomfort.

CASE X.—K. E., male, aged forty-eight years, reported that he had been suffering with general neurasthenia for many years; he has only complained of disturbance of his digestion, however, for the last seven months; the symptoms associated with this condition are fulness, distention, nausea, and vomiting of large quantities of clear fluid following his meals. Physical examination reveals nothing abnormal; after an Ewald test breakfast 350 c.c.

of contents was removed, of a total acidity of 42; free HCl, 0.13 per cent.; specific gravity, 1012; proportion of solid to liquid sediment, 14 to 86; erythrodextrin reaction marked. After a dry test meal 125 c.c. of contents was removed, with a total acidity of 40; free HCl, 0.36 per cent.; specific gravity 1012; proportion of solid to liquid sediment, 20 to 80; erythrodextrin reaction marked. The patient gradually recovered his health. This was accomplished by means of a sojourn in the mountains in connection with the regulation of the diet and the internal administration of belladonna. An Ewald test meal given three months after the patient recovered revealed the fact that but 50 c.c. of gastric contents could be obtained, with a total acidity of 42; free HCl, 0.11 per cent. The stomach was found completely empty after employing a dry test meal.

CASE XI.—J. S., male, aged fifty-nine years, has been suffering with a disturbance of his digestion for three years, his symptoms consisting of extreme constipation, nausea, eructations, and pressure and fulness after meals. The patient is quite nervous, and suffers greatly with insomnia. He has lost twenty-three pounds in weight. Nothing abnormal can be detected on physical examination. After an Ewald test breakfast 240 c.c. of gastric contents was obtained, with a total acidity of 74; free HCl, 0.21 per cent.; specific gravity, 1011; proportion of solid to liquid sediment, 12 to 88; amidulin reaction marked. After a dry test meal 154 c.c. of contents was obtained, with a total acidity of 55; free HCl, 0.16 per cent.; specific gravity, 1008; proportion of solid to liquid sediment, 18 to 82; erythrodextrin reaction present. The patient was entirely relieved of his discomfort by means of a rest cure extending over six weeks.

CASE XII.—T. M., female, aged thirty-four years, has been suffering with indigestion for ten years; she has lost much flesh, thirty pounds in the past three years, and complains much of nausea, pressure and fulness after meals, eructations, and occasionally of vomiting and of extreme constipation. On physical examination nothing but a marked gastropsis can be detected. After an Ewald test breakfast 344 c.c. of contents was obtained, with a total acidity of 28; free HCl, 0.036 per cent.; specific gravity, 1007; proportion of solid to liquid sediment, 26 to 74; achroödextrin reaction marked; after a dry test meal 205 c.c. of gastric contents was obtained, with a total acidity of 20; free HCl, 0.018 per cent.; specific gravity, 1006; proportion of solid to liquid sediment, 16 to 84; achroödextrin reaction marked. The patient was given a rest cure extending over a period of five weeks and was discharged much improved.

CASE XIII.—S. C., male, aged forty-five years, has been very nervous for over three years; he is frequently depressed, often excitable, and suffers very severely with mental depression. During the entire period there has been more or less gastric disturbance,

in the form of pressure and fulness after meals, and eructations and nausea. The patient has lost twelve pounds in weight. On physical examination nothing abnormal can be detected. After an Ewald test breakfast an average of 248 c.e. of contents was obtained, with a total acidity of 55; free HCl, 0.11 per cent.; specific gravity, 1014; proportion of solid to liquid sediment, 25 to 75; erythrodxtrin reaction marked; after a dry test meal an average of 195 c.e. of contents was removed, of a total acidity of 44; free HCl, 0.13 per cent.; specific gravity, 1012; proportion of solid to liquid sediment as 14 to 86; erythrodxtrin reaction marked. The patient was entirely relieved of this discomfort by carefully regulating his diet, mode of life, and by the administration of eumydrin.

CASE XIV.—J. D., male, aged twenty-nine years, has been suffering with indigestion for over six years. At times he would apparently be perfectly well, but the slightest excitement or worry would occasion much gastric distress. The patient complains of nausea, fulness after meals, and occasional heartburn, together with headaches, insomnia, and great irritability. On physical examination nothing abnormal can be detected. The patient has lost twenty-two pounds in weight. After an Ewald test breakfast an average of 22 c.e. of contents was obtained, with a total acidity of 700; free HCl, 0.16 per cent.; specific gravity, 1008; proportion of solid to fluid sediment, 19 to 81; amidulin reaction present. After a dry test meal an average of 184 c.c. of contents was removed, of a total acidity of 55; free HCl, 0.15 per cent.; specific gravity, 1010; total solid to fluid sediment, 20 to 80; erythrodxtrin reaction marked. The treatment of this patient consisted of a carefully regulated diet, exercise, baths, and the administration of belladonna. He was not, however, benefited.

CHRONIC PANCREATITIS.

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CHRONIC pancreatitis was carefully described by Fitz¹ in 1887. He even described most of the varieties, and I believe it fair to say, was not less familiar with the symptomatology than we are at the present day. The condition slumbered somewhat peacefully after Fitz's paper, but of late years, very largely owing to the persistent efforts of Mayo Robson² and the enthusiasm of the surgeons

¹ New York Med. Rec., 1890, xxxv, 197.

² Hunterian Lecture, 1904; Truhart, *Pancreas Pathologie*, Wiesbaden, 1908; Leven, *Jour. Med. Research*, 1907; Guleke, *Archiv. f. klin. Chir.* lxxviii, 845; Martina, *Deutsch. Zeit. f. Chirurgie*, 1907, lxxxvii; Walko, *Münch. med. Woch.*, 1907, 1460; Dieulafoy, *Press médicale*, 1907, No. 83.

for new fields of endeavor, it has begun to arouse widespread interest.

Our knowledge of chronic pancreatitis, at least so far as its morbid anatomy is concerned, is in a reasonably satisfactory condition. The ordinary form, as in all other forms of chronic inflammation, consists of degenerative changes in the cells and proliferation of the connective tissue associated with round-cell infiltration. The etiology of this condition may vary. Among the known causes are obstruction of the pancreatic duct or ducts, which may be produced by lodgement of a gallstone in the ampulla, first described by Opie;³ or the presence of calculi in the ducts, commonly composed of calcium carbonate, which are in all cases associated with more or less focal and sometimes with general sclerosis of the pancreas; or the infection, if it may be so called, of the pancreatic tissue by the route of adhesions in its immediate neighborhood; or possibly by the existence of certain general infectious diseases, as the type of chronic pancreatitis described in newborn children suffering from hereditary syphilis. Cysts of the pancreas are also commonly associated with more or less extensive sclerotic changes, and it is possibly the rule rather than the exception that after attacks of acute pancreatitis chronic pancreatitis is apt to develop, as in a case recently reported by Albrecht,⁴ which was followed for a year and found to have developed an alimentary glycosuria and a diminished amount of trypsin in the stools. Similar cases have previously been reported. There is also a type of chronic pancreatitis, first described by Ssobolew,⁵ characterized by the disappearance of the islands of Langerhans and associated particularly with the severer forms of diabetes. If we attempt, however, to discuss chronic pancreatitis from a clinical standpoint, we find that it is in a deplorable state at the present time. Various observers, particularly surgeons,⁶ following the lead of Mayo Robson, have insisted that it is a common condition, but the majority of medical men, even those who have had their attention particularly directed to the subject, have been unable to confirm this statement, and a considerable degree of willingness to diagnose morbid conditions of the pancreas has not led to the discovery of any large proportion of patients in whom even a reasonable suspicion of their existence seemed to be justifiable. One need only read the three pages devoted to the symptomatology in the recent work of Robson and Cammidge⁷ to realize how indefinite the

³ Johns Hopkins Hosp. Bull., 1901, vii, 397; Diseases of the Pancreas, 1903.

⁴ Wien. klin. Woch., 1909, No. 43.

⁵ Centralblatt f. allg. Path. u. path. Anat., 1900, xi, 204. Ohlmacher, AMER. JOUR. MED. SCI., 1904, cxviii, 287. Opie, loc cit.

⁶ Deaver, Trans. College Phys., Phila., 1909; Mayo, Jour. Amer. Med. Ass., April 11, 1908.

⁷ The Pancreas: Its Surgery and Pathology, Philadelphia, 1907; Brugsch, Zeit. f. klin. Med., 1906, lvii; Schneider, Münch. med. Woch., 1907, 13; Walko, Archiv f. Verdauung., 1907, xiii; Mayo Robson, Berl. klin. Woch., 1908, Nos. 4 and 7.

picture is at the present time. Practically the symptoms resolve themselves into (a) some discomfort apparently associated with the stomach, (b) evidence of indigestion, (c) pain of any degree or variety, sometimes in the neighborhood of the umbilicus and sometimes elsewhere in the abdomen, and, as more definite signs but only occasional, (d) jaundice, (e) a distended gall-bladder, and (f) a more or less evident mass in the region of the umbilicus that can be differentiated occasionally from the stomach. In addition to these indefinite signs, there are a number of laboratory tests, concerning the accuracy of which there is much difference of opinion, depending largely upon the enthusiasm of the investigator who has studied them.

Basing my remarks rather upon the study of literature than upon many personal observations, I am inclined to think that we can classify cases of chronic pancreatitis into three clinical types. The first type may be represented by the group of cases in which either as a cause or as a complication of the sclerosis, there is obstruction of the duct of Wirsung and the common bile duct. Among these are particularly the instances of lodgment of a gallstone in the ampulla of Vater. These cases are all characterized by jaundice, sometimes also by distention of the gall-bladder producing a palpable tumor, emaciation, digestive disturbance, and the various changes in the secretions and discharges available for examination, that indicate deficient functional activity of the pancreas. If in addition there is a history of gallstone colic and a palpable mass in the region of the umbilicus, which may also be tender, it would seem that a correct diagnosis should be reached. The second type includes cases in which the swelling of the head of the pancreas is so great that a palpable tumor is present. There may also be jaundice, which frequently is of the most intense character, and the other symptoms that have been described. I do not believe, however, that the diagnosis can be made with certainty, because, until the operation, and in many cases even afterward,⁸ there will be doubt whether the case is one of carcinoma of the pancreas or merely a chronic pancreatitis. The third type includes the group of cases, and presumably much the larger group, in which there is neither jaundice nor a palpable mass. At the present time the diagnosis of these cases is exceedingly indefinite and uncertain, and is made either by the surgeon at the time of the abdominal operation by feeling the increased hardness of the gland, or by the clinician as a result of a careful study of all the possibilities, the exclusion of those morbid conditions which might reasonably be suspected, but are not present, and a careful correlation of the symptoms, signs, and laboratory tests that may indicate or suggest impaired functional activity of the gland.

⁸ Glaessner, *Deut. med. Woch.*, 1903, No. 15.

The symptomatology of these forms may be given as follows:

Nutrition is almost invariably impaired and the patient is emaciated, sometimes to an extreme degree. Digestion is disturbed. There is discomfort after eating, and often this discomfort can be associated with certain articles of food, particularly the carbohydrates. The discomfort does not appear to have any characteristic type. It may be a sense of oppression, or fulness, or of actual pain. Vomiting occurs quite constantly, but it may be only at long intervals. It rarely occurs immediately after taking food unless the condition of the patient is very grave, but may occur in the morning or some hours after taking food, and is usually preceded by some hours of discomfort. Constipation is the rule. Occasionally there are attacks of diarrhoea, but chronic diarrhoea does not appear to occur.

The main factor in the diagnosis is the recognition by some chemical or other test of the insufficiency of the pancreatic secretion. These tests may be divided into the following groups:

1. Those showing disturbances of the internal secretion of the pancreas, if such a secretion exists at all.

2. Those which have to do with the recognition of the existence, in the stomach or intestinal contents, of some of the pancreatic ferments. When they can be demonstrated it is assumed that the pancreas is still functionally active.

3. Those which indicate whether the pancreatic ferments have been discharged into the intestinal tract and have properly digested the food material that has been brought to them.

4. Those which show a disturbance of the carbohydrate metabolism.

Under the first group belongs the dilatation of the pupil after the instillation of adrenalin. This was first suggested by Loew⁹ as a clinical test, although it had been used in the physiological laboratory for some time previously (Ehrmann, Meltzer). Personally, I have tested it a number of times, and in the two cases I shall report herewith it was negative. It was distinctly positive in one case of pernicious anemia, but no autopsy was obtained in this case. The Cammidge reaction was negative, and there was no particular reason to suppose that the man had chronic pancreatitis or suppression of the functional activity of the pancreas, although it is entirely possible. In a number of doubtful cases it was also negative, so that among some thirty tests, I have obtained it only once. It is of exceedingly doubtful value.

The second group is more interesting. Volhard,¹⁰ following the lead of the physiologist Boldireff, has attempted to obtain regur-

⁹ Münch. med. Woch., 1907, p. 1411; Bard, Archiv. d. mal. de l'app. digest. et de la nut., 1908, xi.

¹⁰ Münch. med. Woch., 1907, 403; Boldireff, Archiv. f. d. ges. Phys., cxxi, 13; Zentralblatt f. ges. Phys. und Path. des Stoff, 1908, No. 3, 209; Farr, Jour. Amer. Med. Assoc., 1910.

gitation of the duodenal contents into the stomach by the administration of large quantities of oil. The duodenal contents are then separated and tested for the presence of trypsin by various methods somewhat more delicate than those commonly employed. The entire literature on this subject has been reported by Farr, together with an elaborate series of experiments. The method is a little difficult, but its difficulties are not prohibitive. The results at present are not sufficiently conclusive or constant for us to base any definite diagnosis upon them.

Laquer's,¹¹ method depends upon the recognition of trypsin in the feces. Small portions of the feces are spread upon a Petri dish containing a layer of coagulated albumin and then kept at 55° C. If a depression appears upon the albumin, it is regarded as an evidence of the presence of tryptic ferment. The technique is very simple and the result easily determined, but in one case of surgical pancreatitis the test was positive and in a series of other conditions it seemed to vary in a most haphazard manner. Various other methods have been devised for the purpose of obtaining the duodenal contents, but none are of any clinical value.

The fat splitting ferment has also been sought in the feces, and Opie¹² claims to have found it once in the urine.

The third group of tests is somewhat less satisfactory. Those tests which involve the passage of some substance through the stomach, and its solution in the intestines only if the pancreatic secretion is active, are so exceedingly uncertain that they may be dismissed merely with a mention. They include the administration of a substance that can be recognized in the urine, saliva, or feces, such as methylene blue, which stains the urine, or of carmine, which stains the feces; of an iodide, which can be recognized chemically in the urine or saliva; or of a salicylate, which can be recognized chemically in the urine. These are administered in such a manner that they cannot be dissolved in the stomach and presumably only by the active pancreatic juice, the principle enclosures being the glutoid capsule and the salol-coated pill. It is my experience, and I believe it is perfectly safe to assert, that no definite conclusions can be drawn either from a positive or negative result of any of these methods.

At one time it was supposed that the digestion of the nuclei in the muscle fibers was a fairly good test of pancreatic activity. The late Dr. J. D. Steele¹³ spent much time and effort in the study of this reaction, and ultimately reached the conclusion that it was of little if any value.

The presence of an excess of neutral fat in the feces (steatorrhœa) is also of uncertain value. The table furnished by Cammidge¹⁴ in his

¹¹ Berl. klin. Woch., 1909, No. 19.

¹² Diseases of the Pancreas, 1903.

¹³ Univ. Penna. Med. Bull., November, 1906; Schmidt, Arch. klin. Med., lxxxvii, 456.

¹⁴ Loc. cit.

work is sufficient proof of this statement. The presence of a large amount of undigested starch or of undigested meat fiber (azotorrhœa) is also of little value. Somewhat less direct than these laboratory methods is the inability of the patient to take large quantities of carbohydrates without suffering a considerable amount of discomfort.

The fourth group of test depends upon the disturbance of the carbohydrate metabolism. The presence of sugar in the urine in the severer forms of chronic pancreatitis appears to be quite common. The presence of alimentary glycosuria, that is, the appearance of sugar in the urine after the administration of 100 grams of glucose, a rather disagreeable dose, appears also to be common, and is a test that should, I believe, be more frequently employed.

The statements regarding the Cammidge reaction¹⁵ are so contradictory and confusing that it is impossible for one who has not done it personally to reach any definite conclusions. It is a reaction very difficult to perform, and, indeed, there have been some who believe that it is not a reaction at all, but merely the result of the different procedures that are necessary in its performance. Even assuming that a reaction exists, there is, I believe, no doubt at the present day that it is not positive but merely suggestive, occurring in many other conditions,¹⁶ particularly achylia gastrica and pernicious anemia.

The treatment of chronic pancreatitis is much disputed. The surgeons have assumed that they only are capable of producing any beneficial results; in other words, that there is no medical treatment.

The surgical treatment consists of draining the biliary passages, in order that, if the pancreatic secretions do not get into the duodenum, at least they do not injure the pancreas by their retention, and of freeing the pancreas of any adhesions that might disturb its functional activity. It is difficult to understand how either measure could favorably effect an advanced sclerosis, but there is no doubt that even when the proliferation of the connective tissue has been so great that the large head of the pancreas has been mistaken for carcinoma,¹⁷ the separation of the adhesions or even sometimes merely an exploratory operation has brought about great relief.

The medical treatment is symptomatic and specific. The symptomatic treatment consists exclusively in the improvement of digestion. The gastric contents should be studied and restored, if possible, to approximately their normal reaction. Food should be easily digestible, and it may be necessary to give a diet similar

¹⁵ Loc. cit.

¹⁶ Kreinitz, *Archiv f. Verdauung.*, 1909, xv, 53; Specse and Goodman, *Trans. College Phys. Phil.*, 1908, xxx, 167; Eloesser, *Mitt. a. d. Grenzgeb. d. Med. u. Chir.*, 1907, xviii, Heft 2.

¹⁷ Glassner, loc. cit.

to that used in diabetes. Constipation should be combated by laxatives or enemas.

The specific treatment consists in the administration of substances designed to supply the missing or defective pancreatic secretion. Carnot¹⁸ is so confident of the efficiency of his therapy that he regards failure to improve after its administration as evidence of the non-involvement of the pancreas. These substances are all preparations of the gland itself. It must be remembered that the preparations of different makers vary extraordinarily in efficiency. Some of the so-called extracts of pancreas, pancreatin, trypsin, etc., are practically inert, and none of them have a proteolytic activity comparable to that of scale pepsin. All the commercial preparations, moreover, are contaminated with bacteria, chiefly *Bacterium coli*. They must, moreover, be administered in such a manner that they are not destroyed by the gastric secretion, because as soon as the pancreatic secretion is brought in contact with the gastric secretion, its activity is permanently lost. For this reason they are given in very much the same way as various test substances; that is to say, either in salol-coated pills or glutoid capsules. The salol-coated pills are objectional because they are very large and very hard to swallow, and leave a painful sensation in the esophagus persisting for several hours. The glutoid capsules, on the other hand, are similar in size and ease of swallowing to the ordinary capsule. After a little experimentation I devised a method of preparing the glutoid capsule which is simple and apparently efficient. The ordinary gelatin capsule was employed, and as soon as it was filled a camel's-hair brush dipped in melted gelatin or hot water was passed around the line of union of the two parts. As soon as this dried the capsule was immersed in pure formalin for three minutes, and then thoroughly washed. Such a capsule filled with carmine stains the feces if given twenty hours before the movement, but it will remain in acid gastric juice in an incubator for twenty-four hours without showing any signs of softening.

The following cases have been under observation respectively for two years and one year:

CASE I.—Mrs. S., aged fifty-four, white, had complained of severe indigestion for over a year. The symptoms were pain, often very severe, two hours after eating, eructation, regurgitation of food, and occasional vomiting. There was a feeling of weight in the abdomen, and the bowels moved only with laxatives. Twenty years ago she had a series of attacks lasting for a period of three or four months. They occurred about once a month and consisted of a gradually increasing pain, which ultimately required morphine. The duration usually

¹⁸ Mal. du pancreas, Paris, 1907; Wohlgemuth, Münch. med. Woch., 1907, 147; Fischer and Hoppe, Münch. med. Woch., December, 1907; Bense, Orvise Hétlap, 1907, 726 (Abstract Zentralblatt d. ges. Stoffw., 1908); Myers, Zeit. f. exper. Path. und Ther., iii, 580.

was two or three hours. Two years ago the climacterium occurred. For the last ten months there have been occasional attacks of severe pain, colicky in character, in the region of the umbilicus, during which she is compelled to lie down and draw up the legs and occasionally to induce vomiting. She has noted that any indulgence in starchy foods or sugars is followed by very severe pain in the abdomen. The interesting features of the examination were a sense of resistance just above the umbilicus, marked tenderness upon pressure from the umbilicus to the xyphoid, and a spot of extreme tenderness one inch above the umbilicus and one inch to the right of the median line that sometimes disappeared if during the pressure the patient took a deep inspiration. The right kidney was in the second position and freely movable. The blood was normal. The stomach contents showed a moderate reduction of the total acidity and plenty of free hydrochloric acid. The urine was negative to the ordinary tests, and particularly did not contain albumin nor sugar. Her weight was one hundred and seventeen pounds, and she was five feet seven inches tall. The character of the pain simulating so exactly gall-stone colic, the tenderness over the position usually occupied by the head of the pancreas, and the absence of tenderness over the gall-bladder led to the suspicion of pancreatic calculus. Dr. Pancoast made two plates, on both of which a small circumscribed shadow was found resembling that of a renal calculus in the supposed situation of the head of the pancreas. He did not think it could have been a calculus of the kidney, gall-bladder, or gallducts, because of the situation. Dr. Goodman examined the urine for the Cammidge reaction, which was positive, and the stool for neutral fat, which was normal. A single test for alimentary glycosuria was positive. The patient suffered greatly after taking the glucose. The Loew pupillary test was negative. The patient was placed upon five grains of extract of pancreatic gland in glutoid capsules, one after each meal. Before this was done her weight had gone down to one hundred and thirteen and one half pounds. From that time the progress was almost uninterrupted. There were a few attacks of pain, but she gained from one to two pounds per week, and now weighs one hundred and forty-eight pounds in about the same clothing that she wore when she first came to my office. She suffers practically no discomfort, and is exceedingly active in social and philanthropic work. No other treatment excepting a brief course of massage has been employed. She has not rested or restricted her diet, and of course she is able to eat much more than before beginning the treatment.

CASE II.—Mrs. M. H., aged thirty-five years, white. In early adult life she had an ischiorectal abscess cured by operation. At the age of twenty-nine blood was occasionally observed in the stools. At the age of thirty-one there was an attack of severe pain in the abdomen, with vomiting. An operation was performed and an incision was made

about three inches long on the right side of the abdomen. The surgeon reports that the examination showed only enlargement and hardening of the pancreas, and the incision was closed. Four weeks before admission to the hospital, that is four years later, a fistula formed in this incision, from which fecal matter and bloody mucus were discharged from time to time. The patient had much pain in the abdomen. The appetite was lost and there was nausea and vomiting of practically everything. She could sleep only under the influence of morphine. At this time she was under the care of Dr. William Evans, with whom I saw her in consultation. He suggested that she be admitted to the Presbyterian Hospital on the service of Dr. H. R. Wharton. The examination showed some resistance just above the umbilicus, but no definite mass, and considerable induration in the right lower quadrant around the sinus. There was considerable tenderness in this region, and diffuse tenderness over the lower portion of the abdomen. The patient was extremely emaciated and pale. There was a loud systolic murmur at the pulmonic cartilage. After admission to the hospital, the urine was examined and found to contain sugar, and Dr. Goodman reported that the Cammidge test was intensely positive. The patient was therefore given extract of pancreas in glutoid capsules. She improved very rapidly. The fistula closed, reopened, and again closed, apparently permanently. The sugar disappeared from the urine, and fifteen days after her admission the report was practically negative. A second Cammidge test, however, was not done. On admission, the red blood cells were 2,930,000. Her weight on August 28 was eighty-five and one-half pounds, and on September 8 it was ninety-six pounds. At this time she was up and about the ward, taking a regular house diet, seemed strong, and felt very well. She said that when she omitted the capsules on one occasion for two days, she felt very uncomfortable in the abdomen, and her nausea returned. She was discharged on October 16, eleven weeks after her admission, practically well. I have since heard from Dr. Evans that she discontinued taking the capsules, but that her condition remained satisfactory.

Although the results in these two cases have been apparently excellent, I have endeavored to keep clearly in mind the fact that no definite conclusions can be based upon two cases, and that the improvement may have been independent of the treatment. I cannot understand how the administration of the extract of the pancreas, which at most can be regarded merely as a substitute for the pancreatic secretion, could bring about any improvement in the actual condition of the pancreas itself, and therefore I do not know why both patients have been able to discontinue the use of the capsules without any apparent tendency to relapse; neither do I understand why such a small amount of extract of pancreas, with its low proteolytic activity and its very moderate digestive power, should so

completely substitute for the supposed indispensable pancreatic ferment that the patients are able rapidly to increase in weight and strength. It is conceivable that there are other factors involved, possibly ferments or neutralizing bodies of whose existence we are at most suspicious, but to assume their existence in order to explain our results is simply piling theory upon theory. At best, therefore, we can only conclude that in the present instances the administration of extract of pancreas appears to have improved the patients, and that its use at the present time must be largely empirical, although there is a possibility of a certain degree of substitution taking place.

Recently an acute intestinal obstruction due to an incarcerated hernia made it necessary to open the abdominal cavity of the second patient again. The desperate condition of the patient precluded any thorough examination, but the surgeon noted that the gall-bladder was distended, and he was uncertain about the size and hardness of the head of the pancreas. The patient made a good recovery, and it is possible that latter a cholecystenterostomy will be considered.

CONGENITAL HEART BLOCK OCCURRING IN A FATHER AND TWO CHILDREN, ONE AN INFANT.

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OUR purpose in this paper is to present briefly the subject of bradycardia and to report three cases in one family, one of them an infant, as instances of heart block, and to show the influence of heredity.

Slow pulse may be physiological, toxic, or infectious, or associated with disease of the arteries, valves, or myocardium. Vagus neuritis, pressure on the vagus, and reflex or direct stimulation of the pneumogastric center in the medulla are occasional causes of bradycardia. Diseases of the spinal cord, pons, or medulla may lead to pressure on the vagus; bradycardia may be found in cases of brain tumor,

especially those of the cerebellopontine angle, and is commonly present in tuberculous meningitis. The slow pulse following the infectious fevers is usually transitory in nature and may indicate real heart block.

Schuster has reported a curious case of bradycardia of intermittent type, not showing the Stokes-Adams syndrome, in a girl, aged four years, with infectious myocarditis following rheumatic fever, which, after several weeks' duration, resulted in a complete recovery. In Schuster's case, five weeks after the onset of acute articular rheumatism, attacks began in the evening with small irregular pulse, of lessened frequency, as low as thirty-five, fall of temperature, slow respirations (10), weakness, restlessness, and profuse sweating; these attacks lasted from one to three hours. The radial pulse and heart beats were synchronous. For three weeks these attacks recurred nightly, then at intervals for several months more. Schuster¹ assumed infectious myocarditis to be present.

W. von Starek² reports the occurrence of the Stokes-Adams syndrome in a boy, aged five years, who suffered from a severe gastroenteritis, and whose heart became hypertrophied while under treatment for the enteritis. The pulse rate varied from 28 to 44, was usually 36. Murmurs were heard all over the precordium. No venous pulse was visible. On recovery from the enteritis three attacks of unconsciousness ensued, lasting one-half to one hour, with general convulsions; the last attack was fatal. Autopsy showed recent endocarditis on the posterior wall of the left ventricle, valves intact, marked cardiac hypertrophy, marked enlargement of the bronchial lymphatic glands, slight interstitial nephritis. Von Starek considered vagus compression from bronchial glands the cause of the slow pulse.

According to Edmund Neusser, a physiological cause for bradycardia is diminution in the automatic excitability of the heart muscle; or we may have diminished blood supply to the medulla on account of aneurysm, aortic stenosis, or arteriosclerosis of the basilar artery. Perhaps the most common condition found at autopsy in marked cases of heart block is sclerosis of the coronary arteries and cardiac fibrosis with degenerative changes involving the bundle of His. Among the toxic causes of bradycardia may be mentioned uremia, jaundice, lead-poisoning (chronic), ptomaine poisoning, etc., and the abuse of drugs such as digitalis and strophanthus.

According to the myogenic theory, the ventricle is stimulated to contract by the impulse which passes from the auricle through the bridge of primitive (embryonal) tissue that connects auricle

¹ Deut. med. Woch., 1896, No. 1x.

² Monatsschrift f. Kinderheilkunde, 1903, ii, p. 11 to 15.

and ventricle, known as the bundle of His, or atrioventricular bundle. Partial or complete block of the heart results from depression of conductivity in the atrioventricular bundle, when the stimulus occasionally or regularly fails to cross the auriculoventricular junction.

James Mackenzie divides cases showing diminished frequency of the pulse into four classes: (1) Those in which all the chambers of the heart participate in the slow action (true bradycardia). (2) Those in which the slow pulse is due to a missed beat or extrasystole, the ventricle having contracted, and the resulting pulse wave being too feeble to reach the wrist (e. g. *pulsus bigeminus*). (3) Those in which the auricle has ceased to beat, or does so synchronously with the ventricle (type of nodal rhythm.) (4) Those in which the stimulus is blocked between the auricle and ventricle so that the auricle beats at its normal rhythm and the ventricle does not respond to the auricular systole, but pursues an independent and slow rhythm—complete heart block.

True bradycardia is encountered in people enjoying perfect health, with pulse rates of fifty to sixty per minute. Most of Mackenzie's cases were tall men.

When there is a genuine bradycardia due to direct or reflex vagus excitation, the pulse rate will be increased by the administration of atropine. If the slow pulse is due to complete heart block, atropine will increase the rate of the auricular systole, but not that of the ventricle (Hoover). In analysing cases of bradycardia the relations of the radial pulse, the heart's impulse, and the venous pulse in the jugular must be compared.

CASE I.—Mr. B., aged forty-one years, contracted typhoid fever in 1889 (at the age of twenty), and suffered from dyspepsia of severe type afterwards. He was treated for gallstones from 1895 to 1900; since then he has been comparatively free from pain and has had no severe attacks.

On one occasion after severe exertion lasting all day, he had general epileptiform convulsions. Attacks of angina pectoris recurred at frequent intervals after this seizure, 1894, 1896. At present Mr. B. is pale, suffers from dyspnoea on exertion, and vertigo on stooping. His arteries show moderate thickening. His average pulse rate is 50 per minute. Lues and alcoholism are excluded. He has worked hard all his life.

CASE II.—Oldest girl, May B., aged twenty years. Pallor marked in infancy. Diphtheria once, not followed by cardiac weakness. Pertussis lasted over three months, followed by persistent cough. Subject to nosebleed. Menses at thirteen, not regular and painful. Suffers from occipital and frontal headache, of the neurasthenic type. Loses her "wind" easily. Does not suffer from vertigo, faintness or dizziness, and has never had convulsions. Pulse 68 in sitting posture, 60 lying flat.

CASE III.—Willā B., aged fourteen years, was always a "nervous" child. At the age of eight years she had her first attack of general convulsions, which came without warning, lasted one to one and a half hours; mother noted complete unconsciousness, pallor, and sweating. No record of pulse was made. There was no vomiting or involuntary micturition. She recovered quickly. These attacks recurred three to four times a week for the next six months, then about once a week for two or three months longer. There have been no attacks in the past five years.

CASE IV.—Leroy B., born April, 1908, full term. The mother nursed the baby altogether for six months; after that supplementary feeding was given and there was considerable digestive disturbance and constipation. Pallor, which was noted from the first, became more marked after the sixth month. The baby was easily fatigued at that time, would sweat freely, and showed dark circles around the eyes. There was never much vomiting, but intestinal indigestion was evident. The abdomen was moderately distended, and the evacuations often of greenish color and offensive. The slow pulse was noted during the first week and varied from 40 to 50; was slower during sleep. In March, 1909, a severe attack of bronchopneumonia occurred, with high fever and extensive involvement of the lungs. While cyanosis was pronounced after severe spells of coughing, on the whole the color was good and the heart withstood the strain of the disease well.

March 1909. Notes made at this time were: Moderate enlargement of the heart to the right (1 cm. beyond sternum). Apex beat forcible, first sound loud, followed by systolic murmur, loud and blowing in character and not transmitted into the axilla or into the vessels of the neck. A systolic thrill was felt all over precordium, and the second pulmonic sound was accentuated. Pulse 58, somewhat irregular. Small doses of digitalis were ordered, and the pulse rate fell during convalescence to 40. The illness lasted one month.

December 2, 1909. Pulse strong and full, 50. Impulse forcible. Apex beat in fifth interspace just outside nipple. First sound of heart clear and strong. Now and then a soft systolic murmur is audible over base of heart. Second pulmonic sound loud, now and then reduplicated. No venous pulse visible.

January 3, 1910. Cardiac dullness extends 1 cm. to right of sternum and 7 cm. to left. Apex beat forcible, fifth interspace just outside nipple line. Epigastric pulsation is present, and a thrill is felt in right carotid. A murmur is heard over whole precordium, louder and rougher at base. Sometimes there is an intercalated sound suggesting imperfect systole. Second pulmonic is louder than the second aortic sound; the former is appreciably accentuated. Pulse 50, full and strong. No jugular pulse, but diastolic venous collapse. Liver one finger below costal border in nipple line. No

rachitis. No signs of arteriosclerosis. Belladonna in full doses does not increase the pulse rate, nor does exertion.

Urinalysis shows no albumin, sugar, or casts. The body is rather undersized.

Blood examination showed a low hemoglobin, 65 to 70 per cent.

April 5, 1910. Pulse 42, same in recumbent posture, not affected by exercise. Color good. Evidence of intestinal indigestion.

The child is bright, vigorous, and intelligent. It was at one time thought that the cardiac murmur above described was due to a patulous interventricular septum, which would, of course, have had an important bearing on the condition of the auriculoventricular bundle, but for reasons which need not be discussed the idea was relinquished.

Pulse tracing 1 was taken from J. S. B., the father, who, it will be remembered, suffered for a long time with syncopal attacks and angina pectoris. It shows an incomplete block with a three-to-one rhythm. The fact that the supernumerary waves in the phlebogram are true auricular waves and not due to extrasystoles is shown by their regular rhythm, and by the absence of any extrasystoles in the cardiogram. It seems quite likely that the severe symptoms referred to above were produced by a complete block. Unfortunately we have no records to show what the radial pulse was at that time. The fact that swallowing, which temporarily stimulates the vagus nerve produces acceleration of the brachial rate, is followed by but very slight slowing, indicates that the tenth nerve does not play the leading role in the production of the auriculoventricular incoördination.

Tracing 2 was taken from the baby, aged twenty-two months, while the radial rate was forty-two. Some of the waves are not as well marked as could be wished, but considering the difficulty in making records from an infant, they are quite satisfactory. There seems to be complete block since the *a* waves in the jugular bear no constant relation to the brachial waves. There can be no question of the fact that there is distinct auriculoventricular incoördination.

Tracing 3 was made from May B., the eldest daughter. It shows an incomplete block with a two-to-one rhythm. The brachial tracing shows an extrasystole which is not followed by a compensatory pause and must therefore arise either in the auricle or in the auriculoventricular bundle. This indicates that the stimulability of the heart muscle is not depressed and that the incoördination is not due to depression of excitability. The auricular waves appear fairly regularly showing that there is no abnormality of stimulus production, and the *a-c* interval preceding each brachial pulse does not exceed the normal limits. It would seem, therefore, that the incoördination was due to the fact that the bundle of His could not recover its functional activity in time to transmit every auricular stimulus, and therefore missed every other one, this doubled period

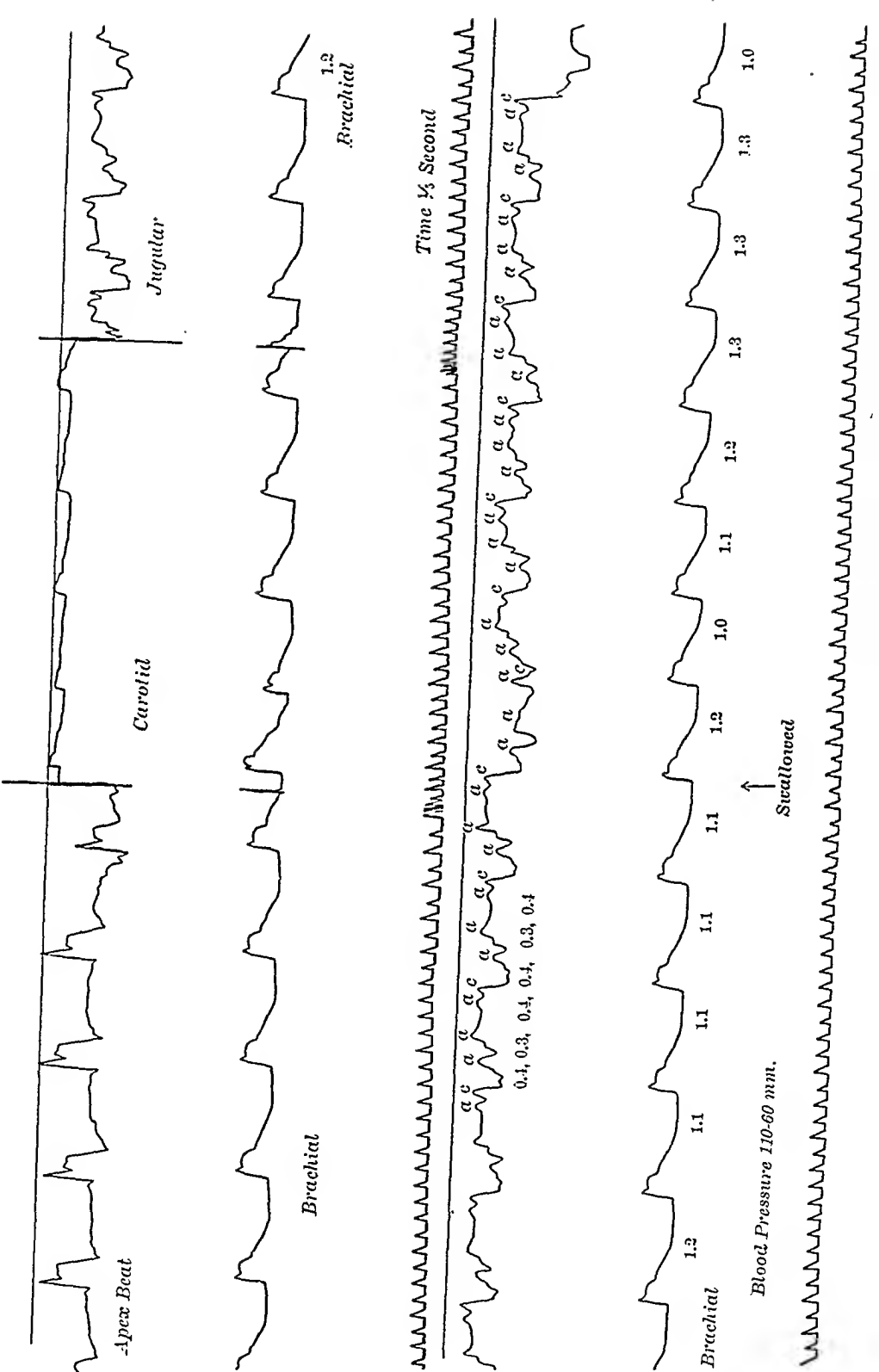


FIG. 1.—Pulse tracings from J. B. S., the father, showing an incomplete block with a three-to-one rhythm. The tracings from the apex beat and the carotid artery are in coördination with the brachial waves, thus excluding the possibility of missed peripheral pulsations due to extrasystoles. Following the act of swallowing, the auricular and the ventricular rates are first increased, then decreased. Pulse rate, 52. Time recorded is one-fifth of a second.

of rest being sufficient completely to restore its functionation. This girl has never had any definite cardiac symptoms, and yet she is accustomed to work hard. She is, however, pale, never feels

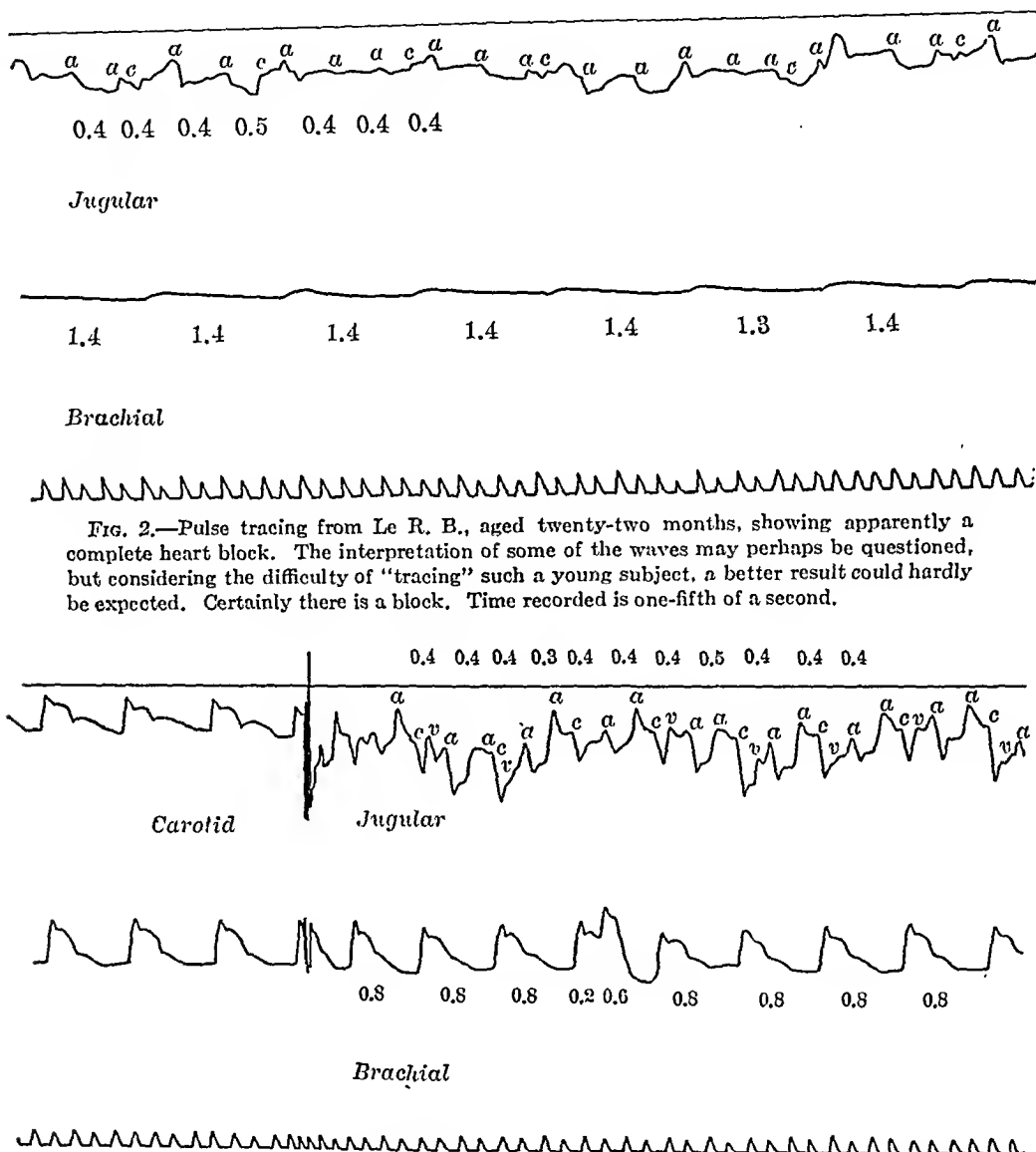


FIG. 2.—Pulse tracing from Le R. B., aged twenty-two months, showing apparently a complete heart block. The interpretation of some of the waves may perhaps be questioned, but considering the difficulty of "tracing" such a young subject, a better result could hardly be expected. Certainly there is a block. Time recorded is one-fifth of a second.

FIG. 3.—Tracing from May B., aged twenty years, showing incomplete heart block with a two-to-one rhythm. In the brachial tracing an auriculoventricular extrasystole occurs, preceded by no *a* wave in the jugular, and followed by no compensatory pause. This indicates that although the conductivity of the bundle is depressed, its irritability is increased. The carotid tracing shows no incoordination with the brachial. The patient is pallid, suffers almost constantly from headache, and although she works hard in the store, rarely feels well. Pulse rate, 75. Blood pressure: systolic, 120 mm.; diastolic, 75 mm. Time recorded is one-fifth of a second.

very well, and is a great sufferer from headaches. At the time the tracing was made she was somewhat excited, and the pulse rate was 75; it is generally about 60.

Tracing 4 was made from Willa B., the second oldest daughter, aged fourteen years. She is fairly well developed, but rather pale. For several years she suffered from syncopal attacks which came on

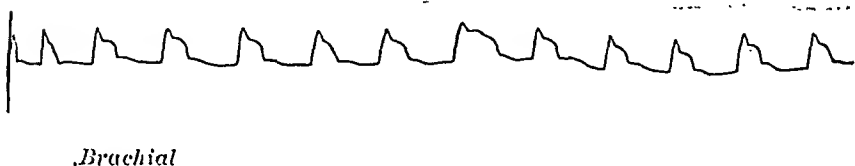
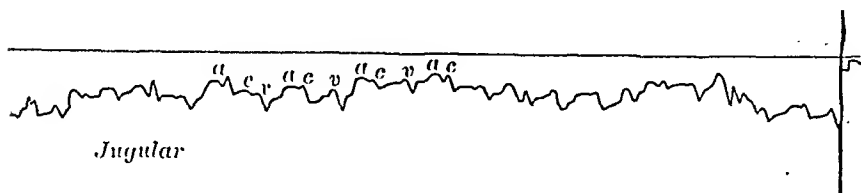


FIG. 4.—Tracing from Willa B., aged fourteen years, showing normal auriculoventricular coördination. Pulse rate, 80. Blood pressure: systolic, 120 mm.; diastolic, 62 mm. For many years she had syncopal attacks while in school, or while playing the piano, often followed by severe convulsions. This condition continued for nearly one year. It was thought that she was epileptic. She is now in excellent health, without cardiac symptoms. Time recorded is one-fifth of a second.

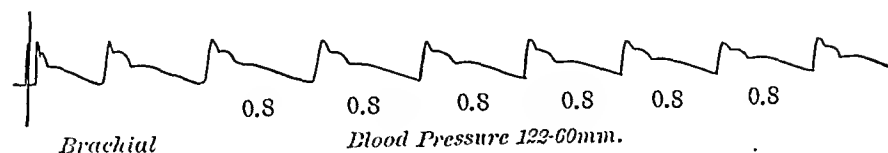
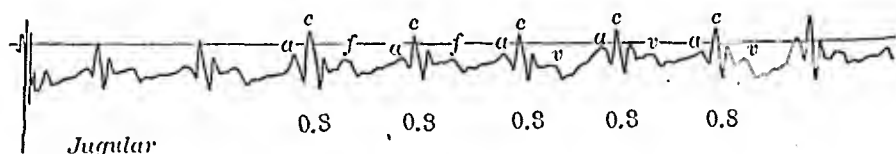


FIG. 5.—Pulse tracing of J. B. B., aged sixteen years, showing normal auriculoventricular coördination. He is robust, and engaged in strenuous athletic contests. He has never had any cardiac symptoms. Pulse rate, 80. Blood pressure: systolic, 122 mm.; diastolic, 60 mm. Time recorded is one-fifth of a second.

while she was sitting quietly at school or at the piano. The attacks were followed by convulsions which were very severe. It was thought at the time that they were epileptic in character. She has outgrown

this condition and is now in good health. It seems more than likely, when we consider the other cases in the family, that these attacks were the result of heart block. The tracing shows a brachial pulse rate of 80 and no abnormalities.

Tracing 5 was made from J. B. B., the eldest son, aged eighteen years. He is a healthy, well developed, robust looking man, who is at present actively engaged in track athletics. He has never had any cardiac symptoms; in fact, prides himself on his "wind." The blood pressure and the pulse tracing are normal. Pulse, 80.

These cases which we have reported are, so far as we are aware, unique in the history of medical literature. A father and two children, one an infant, whose auricles and ventricles are constantly in a state of incoördination, with strong probabilities that one of the other children was for a period of over a year afflicted with a similar condition is certainly most surprising. Until within a very short time it seemed fairly well established that when a condition of auriculoventricular incoördination existed for prolonged periods of time, we were dealing with some degenerative changes in the bundle of His, such lesions as gummas, sclerosis, necrosis, fatty degeneration, etc., having been demonstrated in a large number of instances. It had, of course, been observed that following acute infections there might be a temporary heart block, generally symptomless except for the slowness of the pulse. Furthermore, the occurrence of block following the administration of digitalis in some cases showed that there might be a temporary depression of conductivity, but this class as well as the preceding one might justly be described as toxic in origin, the former to an infection, the latter to a drug. The case of heart block with intermissions and recurrences of the condition recently reported by Earnshaw³ shows that we still have much to learn regarding the pathology of the auriculoventricular bundle, and the cases which we here report while quite different in character; lead to a similar conclusion. To find an hereditary and apparently congenital tendency to auriculoventricular incoördination is certainly very suggestive. It naturally leads to the thought that perhaps some of the people who "normally" have pulses ranging in the sixties may have some defect of conductivity. Thus Osler⁴ mentions a family most of whose members had a pulse rate of about sixty, one of whom died of the Adams-Stokes syndrome. The records which have come down to us regarding the slow pulse and convulsive attacks of Napoleon are interesting, but there seems to be some doubt of his having had the bradycardia.

Our tracings clearly show that the bradycardia is not due to negative chromotropic influences—abnormal stimulus production—

³ AMER. JOUR. MED. SCI., April, 1910.

⁴ Lancet, Aug. 22, 1903, p. 517.

since the α waves appear with regularity in the phlebogram. They also show in Case III that they are not due to negative bathmotropic influences—depression of stimulability—because a nodal extrasystole occurs. They further demonstrate that the slow pulse is not due to negative inotropic influences—depression of contractility—because the brachial pulses are full and strong, and show no suggestion of a *pulsus alternans*. We have but one other possible cause of bradycardia left, and that the commonest cause, namely, negative dromotropic influences or in other words, depression of conductivity.

Concerning the cause of the depression of conductivity in the present series of cases, we can only speculate. Gross anatomical changes in the bundle can be excluded, as can also toxemia. Belladonna administered to the baby until the full physiological effect was manifested by flushing, produced no results on the pulse rate, a fact which tends to corroborate the conclusions which we have drawn from the pulse tracings, to the effect that the vagus is not to blame for the depression of conductivity. Thus tracing 1 shows that the act of swallowing which stimulates this nerve, first increases then decreases both the auricular and the ventricular rates. Another tracing from Case III, which is not reproduced, also shows an increased ventricular rate after deep breathing and swallowing, the pulse intermissions dropping from 0.8 to 0.6 and then increasing to 0.9 of a second.

There is evidence to show that digitalis, which slows the pulse, does so mainly by decreasing the auricular rate and through it the ventricle, and this drug acts upon the human heart mainly through the pneumogastric nerve. Stimulation of this nerve has also been shown to depress conductivity, since atropine which inhibits the action of the nerve, may modify or cause a heart block to disappear. Our tracings show, however, that stimulation of the vagus by swallowing is productive of only very slight results, hardly more than could be considered normal. If overaction of the vagus were responsible for the block in our cases it is more than likely that we should get some more striking results from the stimulation and depression of this nerve than has been the case.

The most reasonable hypothesis which we have been able to formulate to explain our cases is that we are dealing with a congenital physiological and perhaps anatomical abnormality in the auriculoventricular bundle or its blood supply, by virtue of which conductivity is restored more slowly than normally.

THE DURATION OF PREGNANCY, WITH A NEW RULE FOR ITS ESTIMATION.

By ELLICE McDONALD, M.D.,
OF NEW YORK.

THE duration of human pregnancy is a question which has been debated by medical men of all ages. The extent of our ignorance has been but little decreased since the devout remark of the great Arabian physician, Avicenna, that "at the appointed season labor comes on by command of God." This observation is generally admitted to be correct. The study of the question is obscured by the difficulty of knowing with exactitude the date of coitus; and when the date of a single coitus is known, it is clear that conception may occur at any day before the first missed menstruation. The length of time during which spermatozoa may live in the vagina and uterus before conception is still unknown, but there is no doubt that this may be for a number of days.

For this reason, in our estimation of the duration of pregnancy it is customary to reckon from the first day of the last menstruation. This allows for an error in the reckoning of at least three weeks. Ovulation is by no means limited to menstruation, and fecundation may take place at any time during the interval between two menstrual periods. Often, however, when there has been but a single coitus, the day of copulation is also the day of conception, or the first day of pregnancy. A number of such cases of conception after a single intercourse were collected by Reid,¹ in which 25 of 43 cases showed the duration to be from 270 to 280 days reckoning from the single intercourse, and in 11 cases pregnancy was prolonged beyond 280 days. One case was delivered 300 days after the single intercourse. Isolated cases of pregnancy after a single coitus have since been reported; but no such large series has been collected.

Observation on animals, particularly cows, whose time of pregnancy is nearest to that of women, have shown that their period of gestation is by no means a fixed time, but may vary from 240 to 321 days. Tessier's² researches, conducted with unusual care over a period of forty years, showed that, while the average duration of pregnancy of cows was 285 days, 321 calved between the 280th and 297th days, 6 at the 298th day, 4 at the 299th day, and 10 between the 300th and 321st days. Earl Spencer's experiments in 724 cases corroborate those of Tessier in that 310 cases calved before the 284th day and 314 after the 285th day. While the variation of the duration of pregnancy in cows is no proof of a similar variation in

¹ *Lancet*, 1850.

² *Mémoires de l'Académie Royale de Science de l'Institut de France*, 1819, ii, 1.

the human animal, it is at least suggestive that a similar variation may or does occur in pregnancy in women.

There is no doubt that pregnancy in women may be prolonged in a certain percentage of cases, and numerous instances of abnormally long pregnancy have been reported. Winekel³ has collected 20 cases which he has discussed in detail, and has accepted 6 cases as authentically proved prolonged pregnancy of 310, 311, 312, 324, and 336 days, with children weighing from 5770 to 7470 grams. Nine of the remaining cases he rejects as not proved, and five were not completely satisfactory. Many other isolated cases have been reported, such as those of Allen⁴ and many others.

While it is difficult in many cases to estimate exactly the probable time of conception, it is conceded by obstetricians generally that prolongation of pregnancy does occur, and that the children of such pregnancies are remarkable for their large size. It is also believed that a proportion of overweight children are carried for more than the average time of pregnancy. While admitting that isolated observations prove nothing in this connection, it is evident that the average duration of many hundred cases weighing 4000 grams, and over, must have considerable force. Winekel has collected 245 cases of this great weight and estimated the duration of the pregnancy as follows, as to the time after the last menstruation:

Duration of pregnancy in days.	After last menstruation.
241 to 260	3.7 per cent.
261 to 270	6.1 "
271 to 280	18.3 "
281 to 290	38.0 "
291 to 300	18.8 "
301 to 310	8.5 "
311 to 336	6.6 "

This collection shows that it is not an isolated occurrence that heavy-weight children are carried beyond the ordinary term of pregnancy; but it is a fairly definite proof that children are often overweight because they are carried for longer than the ordinary term. While it is true that large infants may be the result of short pregnancies, as was the case in 3.7 per cent. of these cases, it is more common that heavy children are the result of pregnancies longer than the average 280 days, as was the result in 71.8 per cent. of this series.

In 31 of the larger babies with an average length of 53.8 cm. and an average weight of 4276 grams, the prolongation of the gestation period was 31 days, counting from the last menstrual period. The average prolongation of the gestation in infants weighing 4000 grams, or slightly less than the preceding, was 8.22

³ Leyden's Deutsche Klinik, ix, 5 to 10.

⁴ Amer. Jour. Obst., 1907, iv, 4.

days, reckoning in the same way from the last menstruation. Thus, also, in children weighing 4000 grams it was found that 30, or 12.2 per cent., had a gestation period of longer than 302 days, the legally determined duration of pregnancy in Germany.

Blau and Christofoletti⁵ also have collected the cases of large children from 68,032 births in the clinics of Schauta and Chrobak for the years 1892 to 1901, in order to determine the correlation of large children and protracted gestation. Among 1778 children weighing more than 4000 grams the pregnancy lasted more than 300 days in 150 cases, and more than 302 days in 135 cases.

There seems, therefore, to be conclusive proof that pregnancy may persist for longer than 280 days, and that, when it is prolonged over term, the resulting child is commonly of large size. These cases cited were clinic cases where conditions were not favorable to large children, as repose favors the increase in weight of the child. Rest, as has been proved by Pinard,⁶ is a factor which may distinctly prolong the pregnancy. This may explain the difference between gestation in summer (277.2 days) and winter (279.5 days) or between married (282.4 days) and unmarried (278.2 days), as has been shown by Pinard.⁷ This influence of quiet and rest will also explain the larger number of heavy children found in private practice, as the luxury of a home influences the weight of the foetus. Letournier⁸ has shown that women who have fatiguing work to do have children lighter in weight than those who are able to rest during their gestation. He found an average difference of 220 grams between these classes.

The type of menstruation, the sex of the foetus, and heredity are all said to have effect upon the size of the foetus and the duration of pregnancy; but none are proved to have any influence.

On the other hand, constitution and habitus do seem to have an influence, as Issmer⁹ found an average duration of 278.6 days in robust women, and 276.8 days in weak women. He also states that there is an average increase of weight of the child in each pregnancy of 224.5 grams. The first child is the smallest, as a rule, and each succeeding pregnancy produces a larger child up to the ninth.

Another artificial cause of prolonged pregnancy is the performance of the operation of ventrofixation of the uterus. A number of long pregnancies with very large children have been reported after this operation. The most likely explanation is that the unequal development of the uterus and the thinning of the posterior wall causes the cervix to be displaced in its relation to the pelvic axis. The early

⁵ Monats. f. Geburtsh. u. Gyn., 1904.

⁶ Dictionnaire de Physiologie, 1905, article Gestation.

⁷ Clinique Obstétricale, 1899, 51.

⁸ Thèse de Paris, 1897; De l'influence de la profession de la mère sur le poids de l'enfant.

⁹ Arch. f. Gyn., xxx, 277, and xxxv, 310.

pains, being weak from the thin walls, are not able to press the presenting part into the os to bring about dilatation. From the various reports it appears that the pains came on and passed off again several weeks before birth actually occurred.

The following list of cases shows the tendency toward the prolongation of pregnancy, and forms another argument against the performance of this operation in child-bearing women:¹⁰

Author.	Para.	Last menstruation.	Labor.	Duration of pregnancy.
Kissler,	2	February, 1903	December 10, 1903	About 43 weeks.
Lynch,	4	11 months antepart.	April 9, 1902	About 44 weeks.
Fuchs,	8	June 4, 1898	March 29, 1899	About 43 weeks.
Kullmouger,	2	August 18, 1897	June 16, 1898	About 43 weeks.
Rick,	3	March 17, 1897	January 16, 1898	About 43 to 44 weeks.
Rick,	5	June 24, 1896	April 5, 1897	About 41 weeks.
Rick,	6	March 28, 1897	March 28, 1898	About 52 weeks.
Stahler,	2	3 weeks overdue	.....	About 43 weeks.
Ahlfeld,	3	Middle of May, 1902	March 19, 1903	About 44 weeks.
Ahlfeld,	3	March 26, 1905	January 10, 1906	41 to 42 weeks.

This phase of the subject is worthy of further study, and it would be well if those reporting cases of pregnancy after anterior fixation should note the duration of pregnancy and the weight and length of the child.

While thus it may be seen that many factors affect the duration of pregnancy, Issmer has also estimated that the size of the foetus bears a relation, as a rule, to the duration of pregnancy, as follows:

48 cm. length averages	271.3 days.
49 cm. length averages	278.4 days.
50 cm. length averages	277.1 days.
51 cm. length averages	282.5 days.
52 cm. length averages	283.6 days.
53 cm. length averages	286.5 days.
54 cm. length averages	290.0 days.

He states that there may be a difference of ten to eighteen days in the duration of pregnancy; but, basing his statements on the average of his large collection of cases, he says that the larger the child the longer is the pregnancy, and that the increase is in the proportion of his table. Large children do also occur in shorter pregnancies, but they are much more infrequent than when the pregnancy is prolonged.

These variations in the duration of pregnancy make it difficult to prognosticate the date of labor. If the usual rule is applied of adding seven days and subtracting three months from the date of the last menstruation, the estimate may be three weeks out of the way; but basing it upon the average duration of pregnancy, it is often correct. However, conception may have occurred immediately before the first missed menstruation, and so give a factor of error.

¹⁰ Deutsche med. Woch., 1906, vii, 250. See complete literature.

Schatz,¹¹ in two abstruse papers, has claimed that pregnancy is divided into physiological double months and periods of various kinds, and claims that labor occurs at the termination of one of these. It is based upon the electric tension of the air, as shown by Arrhenius to be 27.3 days and which Schatz claims to be paralleled by the average duration of menstrual periods. This theory differs but in the complexity of its language from that held by ancient obstetricians, that labor occurred upon the date of a menstrual period. Unfortunately, however, there is no such exactitude, and the obstetrician must continue to take his fitful rest with one ear, cocked, listening for the telephone bell announcing the advent of a labor, the date of which he has no means of exactly determining.

Since, however, the attempt to estimate the duration of pregnancy by the number of days is inexact, it might be well to attempt to estimate the duration of pregnancy from the size of the foetus. For, if the foetus may be measured and the average size of the foetus is known, the date of labor will be when the foetus arrives at average size in the great majority of cases.

So, with the hope of being able to determine the date of labor, I have evolved a rule which is dependent upon the height of the fundus of the uterus above the symphysis. The height of the fundus is dependent upon the occipitococcygeal measurement of the child, and this varies in direct proportion to the weight of the child, as does the length. The details of this proportion have been worked out in a previous paper.¹²

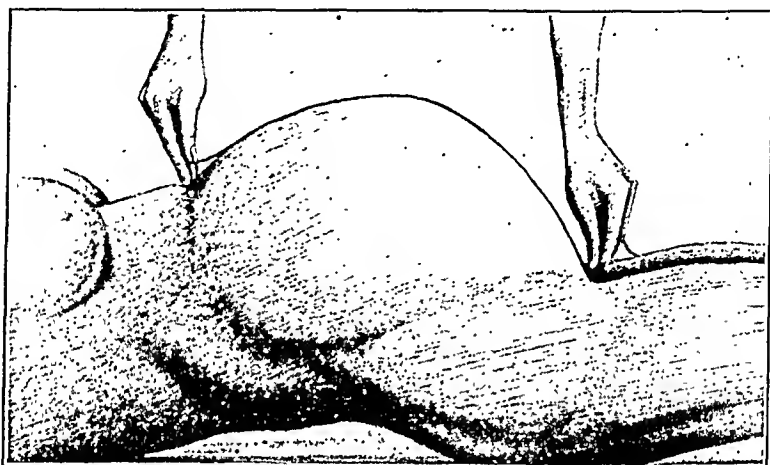
The rule is as follows: The duration of pregnancy in lunar months is equal to the height of the uterus in centimeters divided by 3.5. It depends upon the more or less regular growth of the uterus of 3.5 cm. each month of four weeks, and is very exact after the sixth month. The measurement is taken with the patient lying flat (see figure), and one end of the tape is placed at the upper border of the symphysis, while the other is held by the thumb into the palm of the hand. The fingers of the upper hand are held at right angles to the fundus of the uterus, and the tape follows the contour of the uterus save at the last dip, as is shown in the illustration. Multiparæ with lax abdominal walls and thin uteri should be supported at the side, so as to bring the occipitococcygeal axis of the pelvis into the long axis of the mother's body.

This method gives satisfactory results and is the most exact means of estimation of the duration of pregnancy. It is strictly an estimation of the size of the foetus; for when the uterus arrives at the height of 35 cm., or full term ($\frac{35}{3.5} = 10$ lunar months), the foetus is of a weight of 3300 grams, or average size, as is shown by the measurements in my former paper. Thus, an average-sized baby usually comes at the average period of pregnancy—hence the rule.

¹¹ Arch. f. Gyn., lxxxiv, 2, and lxxx, 3.

¹² Mensuration of the Child in the Uterus, Jour. Amer. Med. Assoc., December 15, 1906.

After the sixth month this rule is extraordinarily exact, and is most useful in determining the date of labor and the size of the fœtus, when the date of the last menstruation has been forgotten. It has been in use in my hands since 1904, and I have had good reports of it from many obstetricians, including some of my German confrères. Hamilton has reported it to me to be of great use in asylum practice in insane pregnant women who are not able to give a connected history of menstruation.



Author's rule: The duration of the pregnancy in lunar months equals the height of the uterus in centimeters divided by 3.5.

It may be said that 35 cm. is the usual height of the uterus at full term with a fœtus of 3300 grams. For every centimeter of height above this measurement approximately 200 grams should be added to the weight of the fœtus. Thus, a uterus measuring 37 cm. would contain a fœtus weighing 3700 grams. The measurements are more exact below 35 centimeters, than above that height.

The so-called "sinking" of the fœtus in the last two weeks of pregnancy causes but little error in the measurement, as the head, when the patient is recumbent, rides upward on the pelvic bones and the sinking is not a factor. "Sinking" in my experience is not common in primiparæ, and its supposed presence is often due to the stretching of the abdominal muscles and not to descent of the head into the pelvis. The fundus thus comes lower in the erect position, and no diminution of the fundal height is noted in the recumbent. This is well shown in Hirst's¹³ photographs of women at various periods of pregnancy. "Sinking" does, however, in multiparæ sometimes complicate the measurement, but not often. Hydramnios also causes but small error, as the excess of liquid does not affect the fundus, but the body of the uterus, leaving the

height of the fundus to be determined by the occipitococcygeal measurement and the size of the foetus.

The rule gives the most exact means at hand of prognosticating the date of labor. No rule can be exact when dealing with such an uncertain quantity as the duration of pregnancy, save that in the majority of cases an average-sized baby is born at the average time.

Thus, if the fundus measures 26 centimeters from the symphysis, the duration of pregnancy is 26 divided by 3.5 or $7\frac{2}{7}$ lunar months, and the patient has $2\frac{4}{7}$ lunar months to go to term, or ten weeks and two days.

This rule, combined with the estimation of pregnancy by reckoning from the last menstruation, gives a fairly exact determination of the probable date of labor.

While the rule is useful for the determination of the date of labor, it is still more useful for the determination of the size of the foetus, with a view to induction of labor for contracted pelvis or other cause. When the fundal measurement is at or near 35 cm., I never hesitate to induce labor when indicated, knowing that there is a foetus of the average weight of about 3300 grams and capable of standing instrumental delivery and not liable to die from prematurity.

When used for the purpose of estimating the size of the child in contracted pelvic or other conditions, it should be used in conjunction with the other methods of measuring the head, etc., as noted in my previous paper on this subject.

FURTHER STUDIES OF SARCOMA OF BONE.¹

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WITH the knowledge of the structural changes in bone that can be gained by means of the Röntgen rays, and with the aid of the newer viewpoints in the histopathology of sarcoma, we are in a position today to acquire a much more thorough and comprehensive conception of the method of growth of sarcomas of bone than has been possible in the past. In a previous publication,² giving observations on 20 bone sarcomas, certain characteristic features were described and their importance in diagnosis was pointed out; the utility of adhering to the histological classification of Borst was demonstrated and a tentative grouping into seven types, each

¹ From the Department of Surgical Pathology of the Mt. Sinai Hospital, New York.

² Surg., Gyn., and Obstet., October, 1909, 431 to 461.

distinguished by certain definite gross morphological criteria, was suggested as being at least of some temporary value. Since that time my own experience has been enriched by a number of additional clinical cases; two more specimens of sarcoma of the long bones have been studied, as well as two cases of multiple myeloma. The very excellent account of Rumpel's³ radiographic findings in bone sarcoma has been compared with the data acquired by x-ray and anatomical investigation of my own material, so that I am able to give a review based on some 30 clinical cases and 46 specimens. Whereas it was possible to give the histopathology of my own material a thorough consideration, the available information on this point in the case of Rumpel's sarcomas is too scant to warrant a comparative exposition of this phase of the subject. I shall, therefore, confine myself to the conclusions that the study of the gross structural changes in 46 cases of bone sarcoma may permit.

Ribbert,⁴ in his admirable inquiry into the development of these tumors, has shown that many of our old notions, particularly in regard to genesis, ought to be abandoned. My own experiences are in the main in accord with his, especially in so far as they concern the probable seat of origin; but they are at variance with his conclusion in the matter of the site of inception of the so-called "peripheral" growths. I shall revert to this later on.

Let me briefly epitomize some of the distinguishing attributes of the bone sarcomas, so that an understanding of individual characteristics may be facilitated.

From a consideration of the many data before us we are led to an endorsement of a view recently advanced, namely, that true "periosteal" sarcomas are probably so rare as to be negligible, and that the bone sarcomas find their inception in a focus somewhere within the confines of the osseous tissue or perhaps just under the periosteal covering. Leaving aside the arguments in favor of this opinion for the present, let us assume the beginnings somewhere within the peripheral layers of the substantia corticalis, in the medulla, in the corticalis itself, or in the spongy bone, and the following structural changes will be seen to take place. There will be a disintegration and disappearance of the osseous tissue and marrow *pari passu* with the enlargement of the sarcoma, although in the case of certain varieties, new bone formation either on the part of the tumor or on the part of the irritated normal bone elements may occur. The method of advance will vary in the way to be described later. Here it suffices to note that sooner or later the heterotypical cells will have destroyed some of the cortex and have found their way under the periosteum, which they will lift off as they multiply. By virtue of this detachment (and possibly also because of

³ Ueber Geschwülste und entzündliche Erkrankungen der Knochen im Röntgenbild Hamburg, 1908.

⁴ Geschwulstlehre, 1904; and Beiträge zur Entstehung der Geschwülste, 1906.

the stimulation of the tumor cells themselves) proliferative changes are induced in the bone covering, and new osseous lamellæ are laid down. In the earliest stages this forms a bony thickening over the cortex indistinguishable from an inflammatory periosteal deposit. Soon, however, the neoplasm tends to encircle the bone, carrying the periosteum with it. A fusiform tumefaction results, the ends of the spindle presenting on section characteristic wedges or triangular areas of periosteal bone. Later, the periosteum too is broken, and its remnants with attached portions of new-formed bone may become included in the tumor.

In this short characterization it has been deemed advisable to call attention only to a very few but essential facts, namely, the origin in the bone tissue or marrow, the destruction of the bone, and the role of the periosteum: for these will aid in the detailed study now to follow.

Turning our attention to the comparative study of our own 22 specimens and of the 24 described by Rumpel, we will find that the tentative grouping proposed by me is also of service in classifying the tumors portrayed in that author's *Atlas of Riadograms*.⁵ The following is the grouping under discussion:

A. CENTRAL (ENDOSTEAL) TUMORS.

1. Expansive of the bone ends.
2. Expansive of the shaft.
3. Diffusely infiltrating (non-expansive).
4. Destructive, dissolutive (non-expansive).
5. Sclerosing (calcifying).
6. Perforative (non-sclerosing).

B. PERIPHERAL TUMORS.

7. Superiosteal and true peripheral.

I. EXPANSIVE TUMORS OF THE ENDS OF LONG BONES. Exquisite examples of this form are the giant-cell sarcomas usually encountered in the lower end of the femur and upper end of the tibia and humerus. They begin as a rule in the spongiosa of the diaphysis, not far from the epiphyseal line and exhibit a marked tendency to bring about complete disintegration of the osseous tissue. By virtue of necrosis, liability to hemorrhage, and regressive metamorphosis, larger or smaller cavities are produced. As for their "expansive nature" (Figs. 1 and 2), this needs qualification, since it is often more apparent than real. Although a moderate amount of enlargement of the extremity of the bone may be produced by the tumor growth even before the investing cortical sheath has been

⁵ Loc. cit.

invaded, this is but meagre when compared with the dilatation incident to the later destructive changes. Complete atresion of the corticalis is the result when the tumor attains considerable size. The periosteum, however, may remain as an encapsulating vestment, and hand in hand with its recession from the surface there occurs the development of new bone, so that a new shell of thin osseous lamellæ may form the chief covering of the neoplasm. The eggshell or ping-pong ball⁶ crackle, therefore, may be elicited by pressure on either rarefied cortex or new formed periosteal bone.

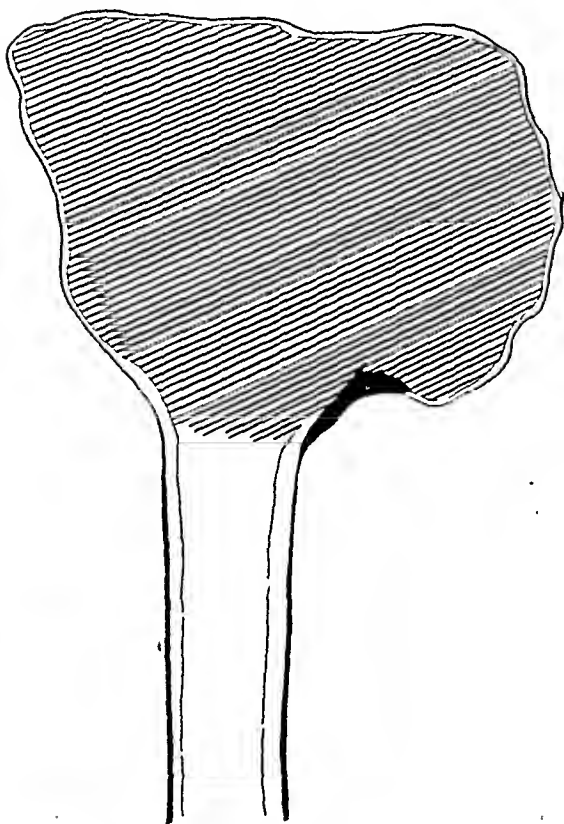


FIG. 1.—Giant-cell sarcoma of the tibia.

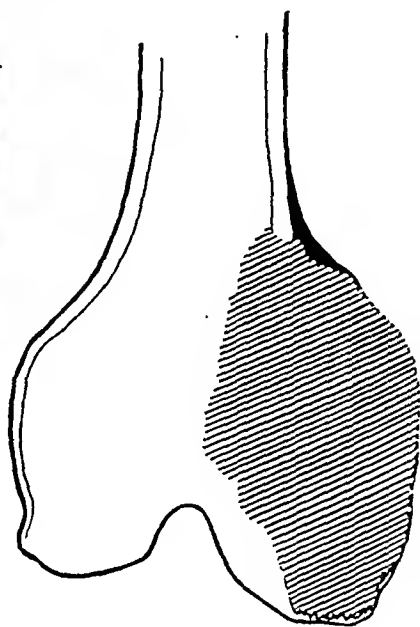


FIG. 2.—Giant-cell sarcoma of the femur.

We may regard the illustrations (Figs. 1 and 2) as depicting types of this variety. The first, a giant-cell sarcoma of the tibia, belongs to my series, and the second, a giant-cell sarcoma of the femur, to Rumpel. Besides the features already mentioned in a general way, we should note the following: The triangular area of subperiosteal bone, the fact that the articular surface is intact, and the evidence of threatened complete destruction of corticalis. Such evidence is seen in Fig. 2, where there is absence of cortex over the upper half

⁶ Suggested by Dr. Bloodgood.

of the tumor, and substitution by delicate new osseous plates. Here the tumor has evidently escaped from its bony confines and is partly extra-osteal, although limited, for the most part, by intact periosteum. Similar growths occur in the upper end of the humerus, although here the dilatation of bone is not clinically as apparent as in the case of the femur and tibia.

It is these tumors that may be easily confused with bone cysts. If we remember that cysts do not perforate, but cause rarefaction and expansion of the cortex, that they are surrounded by a smooth bony wall, and that reactive bone proliferation either in the bone itself or on the part of the periosteum does not occur with them, we shall have at our disposal a sufficient number of data for differential diagnosis.

That other forms of cystic sarcoma (myxosarcoma) and more malignant varieties (osteoblastosarcoma) may also belong to this group, I have already mentioned elsewhere.

II. EXPANSIVE TUMORS OF THE SHAFT. A brief mention of the occurrence of expansive tumors in the diaphysis will be enough to acquaint us with this type. In my series there was a chondrosarcoma of a metacarpal bone and one of the femur. In Rumpel's list there was a sarcoma developing in an enchondroma of the humerus which had much in common with my specimen of the femur. The same picture of bone destruction that is seen in the last type occurs here. The available material is hardly adequate to allow of formulating any definite rules as to what radiographic pictures ought to be expected. It is evident, however, from the data at hand, that some difficulty in the differentiation between benign enchondroma and chondrosarcoma can hardly be avoided. A reference to Fig. 3 illustrates how the picture characteristic of enchondroma may be produced by a cartilaginous growth whose tissue showed, microscopically, unmistakable traits of malignancy, although a true malignant nature could not be clinically proved in this case. In the enchondromas (Fig. 4) we not rarely encounter multiple tumors that cause disappearance of the osseous tissue, leaving a structure which in the x-ray picture has a speckled and rarefied appearance. The absence of periosteal deposits is one of the most important aids in distinguishing them from many of the types of central sarcoma of bone.

Two other conditions that may stimulate the central expansive sarcomas of the shaft may be mentioned—bone cysts, and cyst formation in so-called "osteitis fibrosa." The enchondromas and bone cysts both from the clinical standpoint and from the skiagrams may be practically identical, so much so that a close relationship seems not unlikely. Indeed, the bone cysts are in all probability the end result of a number of different types of endosteal disease. It is not my purpose here to enter into a discussion of the differential diagnosis between these conditions and sarcoma, inasmuch as this can

be best treated from a consideration of a large number of radiographic plates. Here it may suffice to call attention to the following points: In bone cysts, fusiform or pyriform bone expansion, rarefaction of the substantia compacta with the greatest absorption at the equator of the tumefaction, and a distinct, regular line of demarcation between cyst and bone tissue, are characteristic; whereas irregular expansion, perforation, extra-osteal masses, periosteal bone deposits, and irregular contour are more apt to be among the qualities of the malignant growths.



FIG. 3.—Chondrosarcoma of a metacarpal bone.



FIG. 4.—Enchondromas of the phalanges and metacarpal bones.

III. DIFFUSE INFILTRATING (NON-EXPANSIVE) TUMORS. Quite a contrast to the last described series is presented by those sarcomas that probably originate in the innermost layers of the substantia compacta or in the medullary substance, when they develop in the shaft, and probably begin in the spongiosa when they belong to the extremity of a bone. Here expansion of the corticalis is missed, and we find a displacement of osseous tissue and marrow, with marked tendency to intramedullary extension. We are often surprised, on section of the bone, to see how far in the longitudinal direction the tumor growth has advanced. Fig. 5 shows the diffuse involvement of the head and shaft of the femur in one of my series of four specimens of this type and illustrates the tendency to pathological fracture, which may be one of the first indications of the presence of these growths. In Rumpel's series I could find but one example—a round-cell sarcoma of the ulna, which is depicted in

Fig. 6. Here we see the wide endosteal extension with relatively little destruction of substantia compacta, and will note the small wedge of bone deposits from the periosteum where that has been displaced by extra-osteal growth. Of the four examples in my collection, there were two of the upper end of the femur, one of the shaft of the tibia, and one of the shaft of the humerus (Fig. 7).

This type ought to be recognized as of clinical importance, inasmuch as an early diagnosis will hardly be made. For the endosteal tumor may have already replaced a large portion of the medulla and innermost layers of corticalis, or may have caused pathological

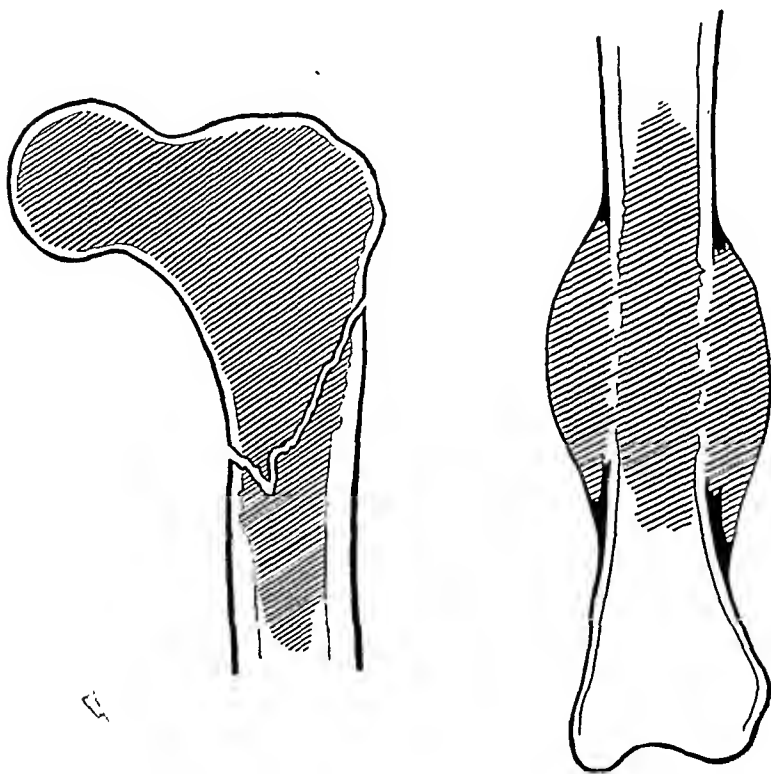


FIG. 5.—Fibrosarcoma of the femur.

FIG. 6.—Diffuse infiltrating sarcoma of the ulna.

fracture, long before a suspicion of neoplasm is entertained. Thus, the diagnosis was made after spontaneous fracture in one case, after osteotomy in two cases, and after careful radiographic examination and exploratory incision in a fourth case. The patients do not usually consult us until after considerable bone destruction has taken place. An illustration of a diffusely growing round-cell sarcoma of the humerus may be of interest in representing this type (Fig. 7).

IV. DESTRUCTIVE, DISSOLUTIVE TUMORS. When a sarcoma becomes so highly destructive that there is rapid dissolution of the whole region surrounding its point of origin, and when there is

neither a tendency to expansion nor to demarcation of the neoplasm, we have a growth which may be grouped under "destructive" or "dissolutive tumors." I have seen some half-dozen such sarcomas of the upper end of the fibula, one of which is depicted in Fig. 8. The invasion of the surrounding soft parts occurs early and the tumors usually pursue a very malignant course. Rumpel's series affords two such specimens, one of the upper end of the tibia, another of the upper end of the fibula. Fig. 9, a diagrammatic drawing from a

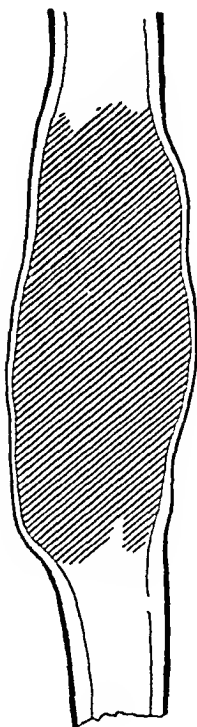


FIG. 7.—Diffuse infiltrating round-cell sarcoma of the shaft of the humerus.

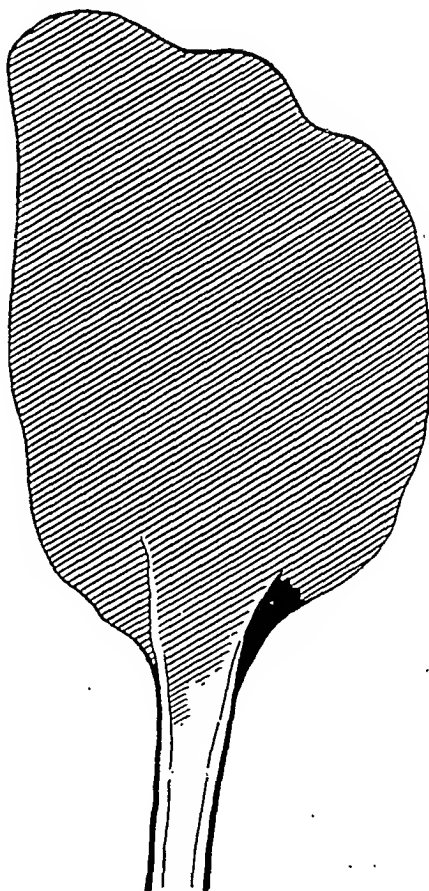


FIG. 8.—Dissolutive (round-cell) sarcoma of the upper end of the fibula.

sagittal radiogram, illustrates the manner of growth in a case in which the upper end of the tibia is completely destroyed and substituted by a very large tumor. Where the tumor merges with the intact shaft are seen some evidences of bone proliferation. The periosteal bone can be traced upward in the form of two irregular lines which represent what is left of a new cortex made of periosteal bone. Here we see a demonstration both of the reactive periosteal osteoplasia and of the fact that the new-formed bone will in its turn be disintegrated by the advancing neoplasm.

V. SCLEROSING, CALCIFYING (OSSIFYING) TUMORS. Perhaps one of the most interesting varieties of bone sarcoma is that in which an osteoid or chondroid matrix is elaborated. Hand in hand with this higher differentiation into a typical bone- and cartilage-producing mesoblastic tissue goes a tendency to sclerosis, in the sense that larger or smaller areas of the tumor are converted into stony masses. This is accomplished either by a sort of lawless calcification or by the deposition of lime in the osteoid matrix and the consequent production of a typical bone. Having already had six examples when writing my last paper⁷ (three of the femur, two of the tibia,

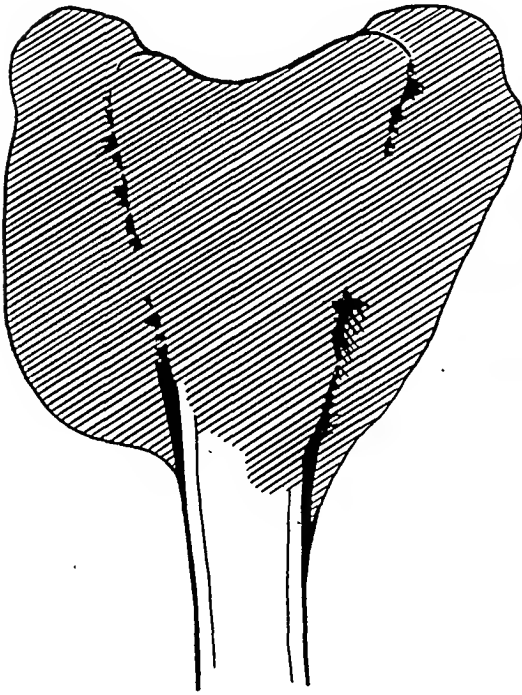


FIG. 9.—Dissolutive, round-cell sarcoma of the upper end of the tibia.



FIG. 10.—Sclerosing sarcoma (osteoid) of the tibia.

and one of a rib), the histological and gross characteristics were sufficiently dealt with at that time. Here it may be permissible, for the sake of clearness, to repeat the following: That calcification and bone formation may be both intra- and extra-osteal; and that the shaft in which such a tumor originates may be converted into a dense petrified mass with such fusion of the remnants of corticalis and intra-osteal tumor, that it is impossible to tell macroscopically where the tumor ends. This remarkable feature of deposition of lime gives a distinctive stamp to the radiograms and is therefore of

⁷ Loc. cit.

service in diagnosis. Thus, Fig. 10, depicting an osteoid sarcoma of the tibia, represents diagrammatically the endosteal hardening, dense masses of line filling the bone and also forming a core in the soft extra-osteal tumor, so that in some of the longitudinal sections an imperceptible transition from calcified tumor into altered cortex can be demonstrated.

When these tumors make their way out under the periosteum, they give rise to the same bone proliferation seen in the other varieties, except that we must expect an additional osteogenetic process in

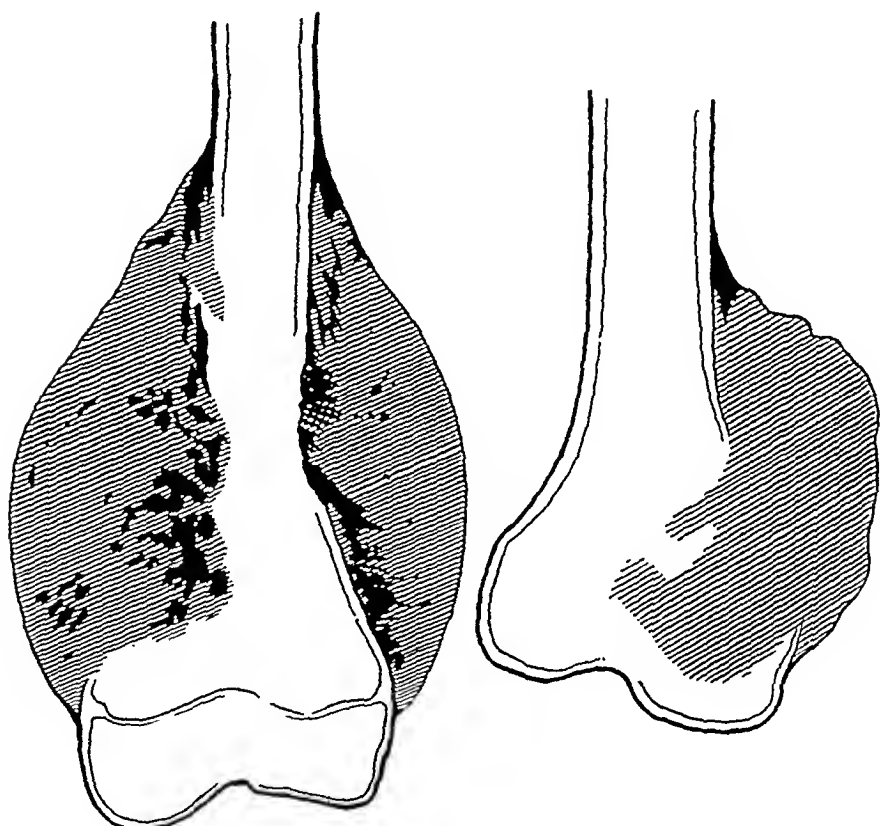


FIG. 11.—Sclerosing sarcoma of the femur. FIG. 12.—Perforative sarcoma of the femur.

the basal portions of the tumor, namely, that which rides on the shaft of the bone. In the extra-osteal tumor-spindle the typical radiate arrangement of bony spicules is sometimes developed, especially in the chondroid varieties. That this feature is not a distinguishing characteristic of the "periosteal" tumors—as was formerly supposed—but belongs rather to those central tumors that stimulate the periosteal variety will become evident from our analysis.

In my own collection, the calcifying and ossifying type was represented only by the osteoid and chondroid varieties, although in one of the round- and spindle-cell tumors, a fair amount of irrita-

tive bone proliferation—on the part of the normal bone—was rather striking. Rumpel pictures marked sclerosis in a spindle-cell sarcoma. Bearing in mind the fact that the sarcomas with specialized intercellular substance, such as the chondroid and osteoid, may, in the course of their growth, revert to immature, low types (spindle- and round-cell forms), and that we not infrequently find soft immature sarcoma in the metastases and extra-osteal masses, it seems possible that osteoid or chondroid substance may be overlooked if the central portions—or the oldest parts—are not subjected to histological examination. Be that as it may, the radiogram from

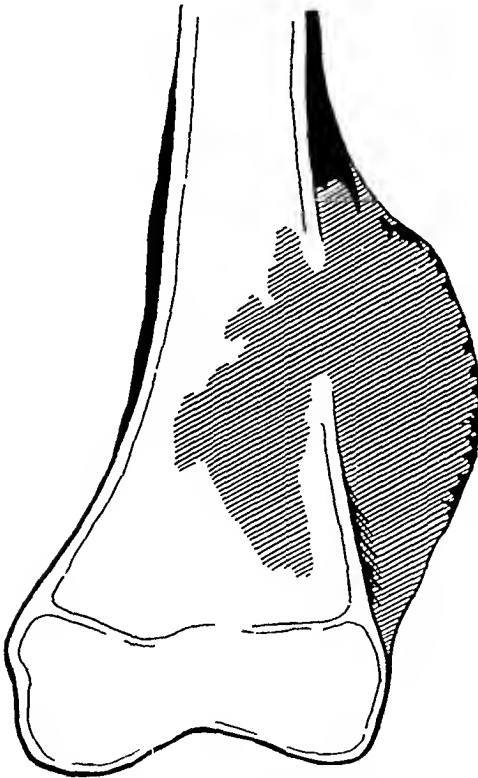


FIG. 13.—Perforative sarcoma of the femur.

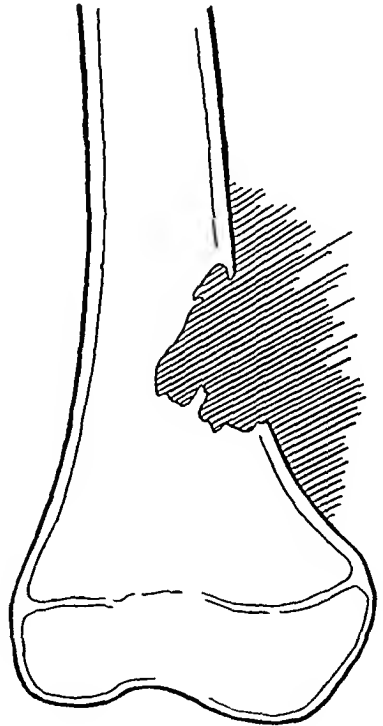


FIG. 14.—Perforative sarcoma of the femur

which Fig. 11 was drawn shows not only the irregular areas of lime infiltration in the extra-osteal tumor, but also the typical spicules and the dense nature of the shaft itself. Whether sclerosis of the nature described can occur in the other forms of sarcoma, I am unable to say from the data at my disposal.

VI. PERFORATIVE ENDOSTEAL TUMORS. Instead of a large central focus causing expansion, or diffuse endosteal infiltration, or extensive bone destruction, or sclerosis, we may see a totally different picture, namely, a small intra-osteal mass causing early perforation. Such a growth is exemplified by the specimen in Fig. 12,

portraying a non-calcifying soft osteoid tumor of the femur. In the analysis of Rumpel's sarcomas, it was found that this type is not at all unusual. Seven of his tumors could be placed into this class, 2 of the tibia, 2 of the humerus, and 3 of the femur. Diagrammatic reproductions of the 3 tumors of the femur are to be seen in Figs. 13, 14, and 15. In all of them the sarcoma had its origin in the spongiosa of the diaphysis, and there was a relatively small endosteal focus with large extra-osteal masses. The other features already sufficiently described can be readily detected by a glance at the illustrations.

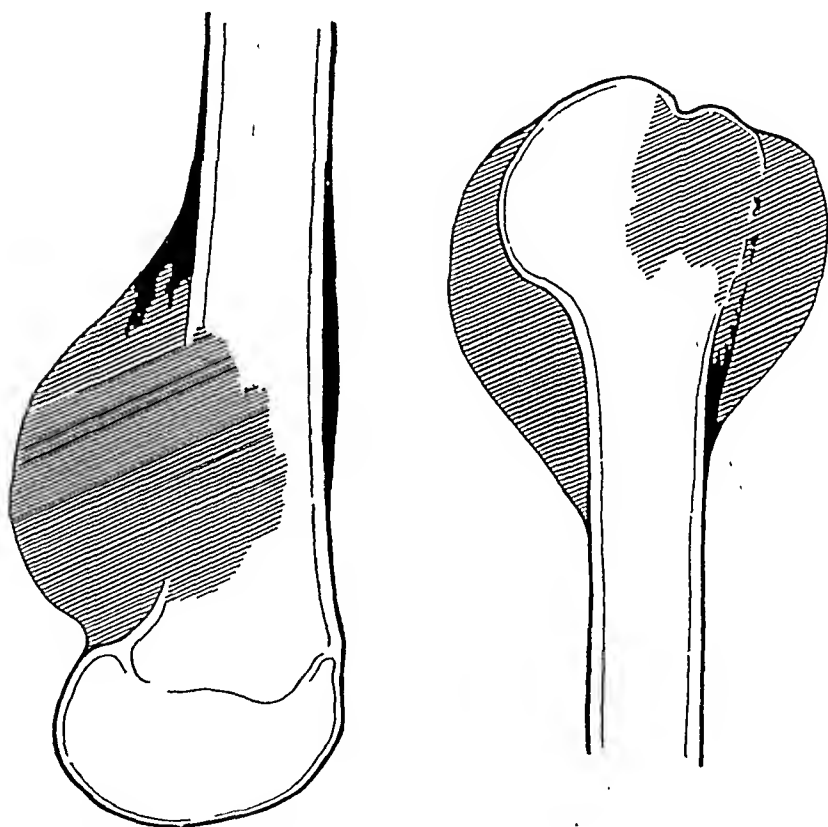


FIG. 15.—Perforative sarcoma of the femur. FIG. 16.—Perforative sarcoma of the humerus.

We need hardly emphasize the difficulty and, in most cases, the impossibility of diagnosing this type of sarcoma before perforation has taken place. When the humerus is affected, the recognition of the condition, even with radiograms, may tax our powers to a still greater degree. The meagre changes in the bone may go with considerable tumefaction of the soft parts and the diagnosis of arthritis may be made. A glance at Fig. 16 will give us a notion as to the lesion in one case.

Another example of this form is shown in Fig. 17, in which the outer

tuberosity of the tibia is occupied by a small tumor which has already made its way out of the bone. Such a tumor must be differentiated from a bone cyst, osteomyelitis, or bone abscess, and from a central gumma. The evidences of a lesion outside of the bone, the irregular contour of the endosteal area of bone absorption, and the periosteal deposits are sufficient to rule out bone cyst. Nor do we meet with the peculiar circumferential osteophytes in central gumma or in abscess.

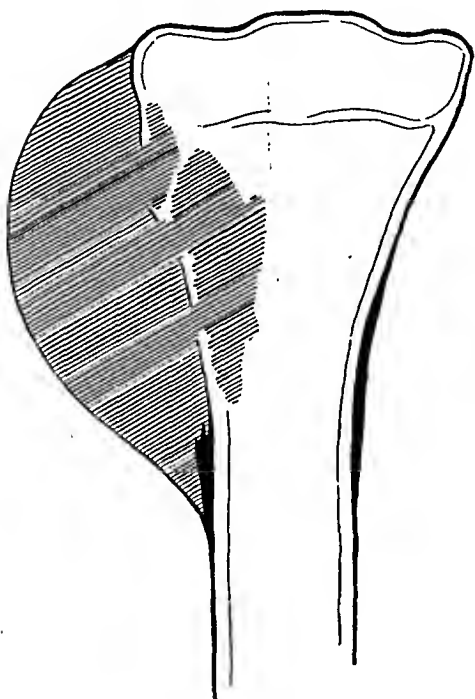


FIG. 17. —Perforative sarcoma of the tibia.

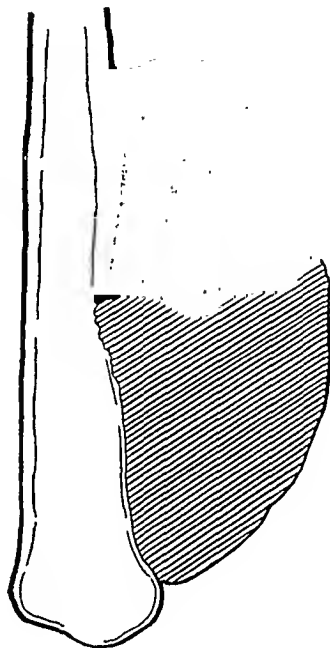


FIG. 18. —Subperiosteal sarcoma of the femur.

VII. PERIPHERAL TUMORS. Having had but one tumor whose origin was either "subperiosteal" or in the outermost lamellæ of the cortex, it would have been audacious to have expressed myself decisively in regard to the moot point of periosteal or peripheral origin in my first paper.⁸ Comparing my own specimen with those described by Rumpel, the conclusion is inevitable that a certain percentage of the bone sarcomas do belong to this class, and that in a series of eight tumors, at least, the periosteum, although affected by the growth, is not the seat of its inception. Turning our attention to Fig. 18, showing a large osteosarcoma⁹ of the femur, the lack of bone disintegration will be noted as a striking feature. Indeed, there is only very superficial arrosion of the shaft, at a point marking

⁸ Loc. cit.

⁹ By osteosarcoma is meant not a sarcoma in bone, but a bone-forming sarcoma.

the beginning of the tumor. This must be taken to lie in all probability in the peripheral layers of the substantia compacta.

We can acquire more information by turning to the sagittal section of a fusiform tumor of the femur sketched in Fig. 19. Our inspection reveals two significant facts—first, the evidence of the osteoplastic activity of the periosteum, and second, the intact condition of the substantia compacta. How these are to be interpreted shall form a topic for discussion when the point of origin of the sarcomas shall receive special consideration.

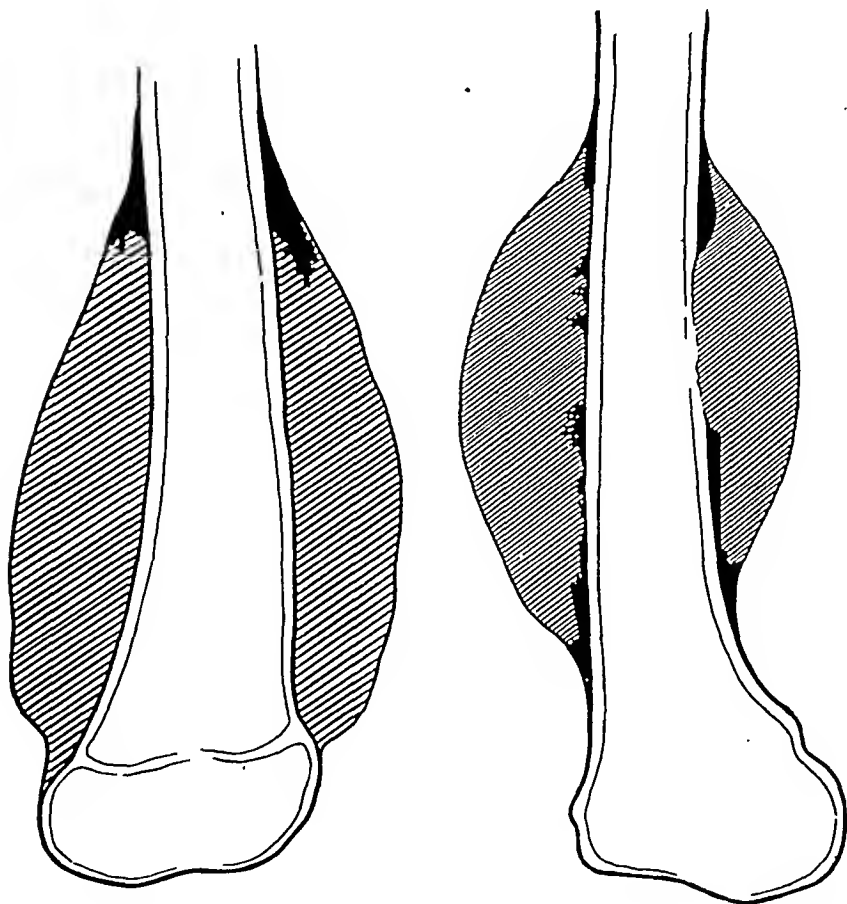


FIG. 19.—Subperiosteal sarcoma of the femur. FIG. 20.—Peripheral sarcoma of the femur.

Perhaps somewhat more comprehensible from the standpoint of genesis is the peripheral sarcoma shown in Fig. 20, in which there is a tumor encircling the shaft. Toward either pole we can detect the strata of periosteal bone deposit, these becoming more elevated as they approach the centre of the neoplasm. Then there is a sudden interruption in the continuity of these lamellæ, and we see a shallow excavation at the posterior part of the shaft. It is at this point that

we must seek the point of origin. We need hardly add many more examples. One more will suffice to give us a definite notion both as to origin, development, and as to what diagnostic points can be expected from the radiograms. How little the shadow pictures may show is apparent when we look at Fig. 21, a diagrammatic representation of a skiagram of the specimen. In the x -ray of the limb there was nothing but the slight indication of circumferential periosteal osteoplasia, and a roughened line indicating surface arrosion. These two features are well shown in the figure. Thus, the characteristic marks identifying such peripheral sarcomas are periosteal bone deposit, eroded bone, and the presence of an extra-osteal mass.

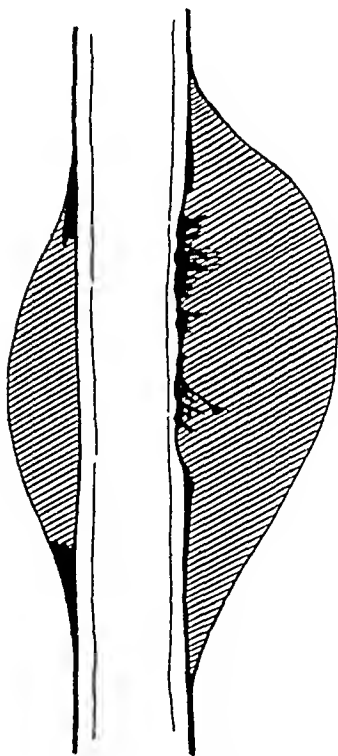


FIG. 21.—Peripheral sarcoma of the femur.



FIG. 22.—Sclerosing sarcoma of the tibia.

Is it always possible to distinguish in the skiagrams the lesions of sarcomas of small extent from those that belong to a traumatic or inflammatory periostitis? The differential diagnosis may be difficult, for the shadow pictures may show only periosteal deposits without appreciable changes in the bone itself. The circumferential type of bone deposit usually speaks in favor of neoplasm, whereas in the traumatic periostitis we are more apt to find irregular, and possibly multiple patches of bone deposit. However, it is clear that even in sarcoma the very earliest periosteal lesion will not have encircled the shaft, and this early neoplastic lesion may, therefore, be difficult or impossible of recognition.

GENERAL CONSIDERATIONS. Having thus outlined the characteristics of forty-six bone sarcomas, and having grouped them according to gross morphological traits, it may be well to gain a broader impression of the subject by tabulating both our own specimens and those of Rumpel and by giving the subject of classification and point of origin more critical consideration. The distribution was as follows:

	Rumpel, ¹⁰	Buenger, ¹¹	Total
Femur	8	11	19
Tibia	5	4	9
Humerus	6	1	7
Fibula	2	4	6
Metacarpal	1	1	2
Radius	1	0	1
Ulna	1	0	1
Rib	0	1	1
Total	24	22	46

In order of frequency we would have femur, tibia, humerus, fibula, and metacarpal. Reinhardt¹² collected 54 cases in which there were 19 of the tibia, 18 of the femur, 13 of the humerus, and 2 each of the fibula and radius. Müller,¹³ in reviewing 209 sarcomas, found the tibia affected 77 times, the femur 70, the humerus 38, the radius 11, the ulna 6, and the fibula 8. The tibia and femur, therefore, take the first place, followed by the humerus, and then by the fibula and radius.

Has the comparative study of this larger number of bone sarcomas given impressions that would tend to strengthen notions already obtained through our previous investigation? I must answer in the affirmative. A suspicion has arisen that perhaps certain of the groups do not possess any essential properties with which the gross alterations are inseparably linked, and that the changes of bone architecture depend for the most part on variations in the site of origin of the neoplasm. However this may be, the establishment of the existence of important widely variant forms is not nullified; and we must concede that, although the assumption as to the rôle of origin may be true in the case of the "border-line" tumors, most of the neoplasms possess a sufficient number of distinctive qualities to allow of the grouping adopted by us. Tabulating Rumpel's tumors and my own, we find the 46 sarcomas grouped as follows:

¹⁰ Includes only those critically studied by me, the data being sufficient.

¹¹ The multiple myelomas are not added. Only specimens which were studied anatomically are included in my list.

¹² Deutsche Zeitsch. f. Chir., 1897, xlvii, 523.

¹³ Inaug. Diss., Kiel, 1904.

		Rumpel.	Buerger.
I.	<i>Expansive of the Extremities of Bones.</i>		
	Femur	2	3
	Humerus	1	
II.	<i>Expansive of the Shaft.</i>		
	Humerus	2	
	Femur	—	1
	Metacarpal	—	1
III.	<i>Diffuse Infiltrating.</i>		
	Femur	—	2
	Tibia	—	1
	Humerus	—	1
	Ulna	1	
IV.	<i>Dissolutive (destructive).</i>		
	Fibula	1	3
	Femur	—	1
	Tibia	1	1
V.	<i>Sclerosing, ossifying, calcifying.</i>		
	Femur	1	3
	Tibia	1	2
	Rib	—	1
VI.	<i>Perforative endosteal.</i>		
	Femur	3	1
	Humerus	2	
	Tibia	2	
VII.	<i>Peripheral.</i>		
	A. Subperiosteal ¹⁴ (shaft)	1	1
	B. True peripheral:		
	Femur (shaft)	1	
	Humerus (shaft)	1	
	Radius (shaft)	1	
	Tibia (shaft)	1	
	Fibula (shaft)	1	
	Metacarpal (shaft)	1	
	Total	24	22

Rather striking is the large number of perforative endosteal tumors, of which I have had but one example, and of which Rumpel—if my interpretation of his radiographic findings is correct—has had 7. This augmentation in the number of examples of a type which had to be separated from the rest in my series (although there was only one) makes it certain that this variety is to be reckoned with. None the less remarkable, and a circumstance which has somewhat altered my former concept, is the large proportion of peripheral sarcomas—7 out of 24 as compared with 1 out of 22 in my list.

Let us set aside the question of the fitness of a special classification as well as the critique of the one proposed until we shall have discussed more fully the manner of growth of the bone sarcomas and their site of origin. We owe much of our knowledge of these two phases of the subject to the admirable work of Ribbert. He was one of the first to emphasize the endosteal origin of these neoplasms, and to recognize the role of the periosteum as being active

¹⁴ With very slight or practically no erosion of the corticalis.

rather in the sense of producing new bone than in the sense of participating in the production of the tumor itself.

In the bony tissue the sarcoma elements soon cause a disappearance of the normal structure, with a rapid resorptive process, the bone melting away, as it were, before the advancing cells of the neoplasm. The bone absorption seems, for the most part, to be the result of the direct action of the tumor cells, although we not infrequently see osteoclasts engaged in a similar process. At the same time, an interesting phenomenon may occur, namely, the deposition of new matrix upon the very bone tissue that is undergoing destruction. Such osteoplasia needs careful interpretation, since it may either be a normal reactive homeotypical bone proliferation, such as is the rule in syphilis and chronic inflammatory processes, or it may be heterotypical or atypical, the result of the activities of bone-forming, osteoblastic sarcoma elements. The former type is usually not sufficient in amount to produce architectural changes that need special consideration from the standpoint of diagnosis in the skiagrams; the latter, on the other hand (belonging par excellence to the osteoid, chondroid, and true osteosarcomas), is responsible for the striking lime and bone metamorphosis which has already received special mention elsewhere. In one of my cases of the dissolutive type of sarcoma of the fibula the "normal" type of bone formation was fairly striking. Indeed, it did much toward preserving the general contour of the bone, just as is the case with the more solid, dense, calcified endosteal sarcomas of the osteoid variety.

By virtue of advance through Haversian canals or by direct extension through places in the substantia corticalis that have undergone complete absorption, the neoplasm finds its way under the perisoteum. The latter becomes separated from its bony support, first over a small area, by reason of the progress of the tumor, and later because of hemorrhages between the periosteum and the surface of the bone. It is now that the peculiar phenomenon of new bone formation under and by the periosteum takes place. A study of the skiagrams of gross specimens reveals the interesting fact that the bone deposition occurs in two forms—either as flat stratified lamellæ, disposed parallel with the long axis and surrounding the bone, or in the shape of fine trabeculæ that have a radiate arrangement, lying perpendicularly to the shaft. Both of these varieties can frequently be found in the same specimen. Although my studies of this particular phenomenon cannot be regarded as sufficiently thorough to warrant a decided opinion, it seems to me now that the following explanation will hold good: The flat lamellæ represent, in part, bony deposits that are the result of bone proliferation from the peripheral layers of the corticalis, and, in part, the proliferation that occurs when the periosteum has suffered but minute separation from the bone. Such separation is

not confined to the immediate variety of the perforating sarcoma tissue, but extends for a considerable distance up and down the shaft and in a circumferential direction. Thus, the first consequence of cortical perforation will be the growth of a thin plate of bone upon the shaft. As the tumor enlarges, a tendency to form a lenticular-shaped growth becomes manifest. The periosteal elevation may occur at intervals, depending upon the subperiosteal tension, and each fresh act of separation will be followed by a new accession of lamellar bone growth. Simultaneous with this another mode of periosteal activity is evidenced in the growth of bone trabecula from the periphery toward and perpendicular to the bone. Such radiate disposition is particularly shown in the radiograms, and according to Ribbert depends on the fact that the perforating vessels have been pulled out in that direction and must to a certain extent determine the direction of the growth. Be that as it may, we need but note that where the bone covering has suffered any considerable displacement, there the radiate arrangement is rarely missed, whereas where the periosteum is separated but a few millimeters or less than a millimeter, the lamellar structure is more apparent.

At the poles of the extra-osteal tumor, where the transition between normal and uplifted periosteum must be sought, a characteristic wedge (in section) or conical shell of bone is regularly seen. The importance of recognizing this structural marking, both in diagnosis and in the estimation of the site of origin, will receive attention later on.

I have thus far called special attention to the proliferative phenomena induced by the extra-osteal growth. It can readily be appreciated, however, that the new-formed periosteal bone will in its turn suffer the same destruction which had already befallen the existing osseous tissue. As a result, the central parts of the cortex of extra-osteal spindle will become deprived of its bony covering. A fibrous capsule, the last remnant of periosteum may be left, or rupture of this may occur, in consequence of which rapid growth into the soft parts or around the periosteum occurs. The periosteum then lies in the tumor mass. This explains the occasional inclusion of periosteum, with its adherent bone, in parts of extra-osteal tumors.

From this description it is evident that, if it is possible to determine the presence of intact periosteum, or to detect evidence of bone proliferation in it, or to trace its dislodgement in the manner suggested, we must be prepared to controvert the opinion that such perisoteum contains in it the nucleus of inception of the neoplasm. We must rather seek a focus under the periosteum or in the bone itself.

After this slight digression into the question of origin of the sarcoma, I shall close the chapter on mode of growth by calling attention to the common varieties of extra-osteal tumor.

The fusiform type is the ordinary variety. This form may give us—as shall be seen later—no indication as to where the beginnings of the tumor lie. Whereas, the true spindle, with tapering ends, may be found when the tumor is limited to the shaft, a blunt, and even fungiform overhang may mark its limit at the extremity of a long bone. The absence of the typical periosteal bone wedge may be ascribed to the dense adhesion of the membrane at the epiphyseal region. Besides this, we need only mention the nodular lobules of extra-osteal metastases occasionally seen, and the irregular forms that belong to the stage of periosteal destruction and infiltration of the soft parts.

THE ORIGIN OF THE BONE SARCOMAS. In the light of what has been said we can now better understand the presumptive point of origin of the tumors belonging to our series. Let me therefore analyze the various groups in the sequence previously given. Having done this, I shall be able to proceed to the critique of the proposed classification, with a more complete appreciation of its merits and shortcomings.

Fortified with the knowledge of the role played by the periosteum in the development of the bone sarcomas, we must abandon the old conception of division into myelogenous and periosteal varieties. Ribbert recognizes central and peripheral forms. The former originate in most instances in the substantia spongiosa of the diaphysis, although they may grow from any point that lies within the outermost layers of the corticalis, and the latter are derived from the outer layers of the periosteal bone. Ribbert would have even these so-called peripheral tumors start near one end of the diaphysis, and creep up or down the shaft. I shall be able to show that at least this latter view is not in accordance with the data at our disposal.

In establishing the location of the beginnings of the malignant tumors, we must bear in mind a few fundamental facts. A tumor will grow with equal rapidity in all directions if the resistance offered on all sides is approximately the same. It is just here in the sarcomas of bone that we encounter several difficulties in the proper interpretation of the point at issue. These are the differences of rate of proliferation in bone and in soft parts, and the limiting powers of the substantia compaeta, of the articular cartilage, and the periosteum. Thus, we cannot off hand place the site of initial growth in the centre of the gross product.

Turning to our series, the expansive tumors of the ends of the long bones will be found to arise from a point somewhere in spongy bone of the end of the diaphysis. Beginning for the most part in the upper end of the tibia or lower end of the femur, the equal enlargement will leave no doubt as to the correctness of the assumption that they are central in origin.

When we come to consider the expansive tumors of the shaft and the diffuse infiltrating type, we meet with a more intricate problem.

Here we may assume either a focus in the marrow, in the innermost layers of the substantia compacta, or in the spongiosa of the diaphysis. In view of the nature of the histological types (giant-cell and chondral), it seems most likely that an osseous rather than a myelogenous focus is their starting point.

The dissolutive form also arises in all probability in the spongiosa of the diaphysis. The equal destruction of the bone ends is sufficient testimony in favor of this view.

Perhaps none of the tumors afford as much food for investigation as the sclerosing and ossifying sarcomas, when they form fusiform bone-encasing spindles, or when they cause that fusion of calcified tumor and bone that makes the identification of neoplasm so difficult. Here we meet with growths that show both endosteal and extra-osteal proliferation. The focus in the bone may be smaller than the mass without. In the interior of the bone there is usually calcification, and often greater in extent than that which forms the petrified core of the extra-osteal masses. In these forms the dense nature of the intra-osteal focus and the evidences of cortical perforation and the separation of the periosteum leave little doubt that they are endosteal in origin. The beginnings were referable to a site in the spongiosa of the diaphysis in 5 of my specimens and to spongiosa of the rib in a sixth.

Exquisite examples of endosteal origin are given us in the perforative type, in which the central focus is usually much smaller than the extra-osteal mass. If we glance at Figs. 12 to 17, inclusive, we shall not escape entertaining the suspicion that perhaps the small intra-osteal tumor is but an expression of invasion from without. Here we are not aided in our estimation of the age of the newgrowth by such a phenomenon as calcification. When we study the relative size of extra- and intra-osteal neoplasms, and keep in mind the greater rapidity of growth outside of the bone, we shall be forced to find the point of origin within rather than outside of the bone. It would be difficult to explain pictures such as are shown in Figs. 12 and 14 on any other basis. The erosion of substantia compacta occurs from within, as Figs. 15 and 17 illustrate; the periosteal spindle has its greatest width at the point of perforation; and the changes in the periosteum pursue the typical course described as belonging to intra-osteal growths.

Thirty-eight of the forty-six tumors under consideration, therefore, have their inception at points lying either in the spongy bone, in deepest layers of the compacta, or possibly in the marrow. My own series (as was already noted in a previous paper¹⁵) shows but one example of a neoplasm which is not central in origin. At that time my experience did not warrant any decisive conclusions either as to the question of the recognition of periosteal growths or as to

the frequency of those that might be classed either as subperiosteal or peripheral. The additional facts gained in the analysis of Rumpel's specimens permits us to take the view that sarcomas do arise from the peripheral layers of the substantia compacta, usually in the shaft, and that Ribbert's assumption of a site of origin in the extremity of the long bones is untenable, at least so far as my own material is concerned. We encounter two types in the eight neoplasms before us. In the first there is a subperiosteal tumor without apparent destruction of bone, and in the second the tumor is associated with those osseous changes that are indicative of the neoplasm's destructive growth. Fig. 19, a diagrammatic illustration of one of Rumpel's cases, shows clearly the periosteal separation, the new bone formation without any appreciable lesion in the bone itself. Such a tumor, distinctly subperiosteal, must have its origin somewhere between periosteum and bone, and still not so intimately connected with either that recognizable dissolution takes place. Let us class these tumors then as of the subperiosteal variety.

When we find a broad sessile, or fusiform tumor on the shaft, with the signs of periosteal detachment, bone proliferation, and cortical erosion, we are led to refer the starting point to the outermost layers of the compacta. How else could we explain the pictures furnished in Figs. 18, 20, and 21. In each the shallow area of bone destruction seems to mark the beginnings of the growth. Fig. 20, perhaps, affords the most conclusive proof: for in the sagittal section we see clearly that the excavated focus posteriorly must have been the oldest lesion, lying as it does between the largest (and in their turn eroded) deposits of periosteal bone; spreading from this point and encompassing the shaft, it has produced elsewhere only the typical periosteal displacement and subperiosteal growth. The same history can be assumed for the neoplasm of the shaft of the femur depicted in Fig. 21.

In none of the specimens analyzed can we place the point of origin near the extremity of the long bone, and we are forced to the conclusion that the outermost layers of the corticalis should be regarded as the point of origin of the so-called peripheral forms.

Let us review briefly the grouping into 7 classes and inquire as to whether these will now stand the test of more careful investigation. Are the points of distinction that permit of this subdivision essential characteristics, are they purely fortuitous, do they depend wholly on the histological variations, or are they in great part but the expressions of differences in situation of the very beginnings of the growths? From what has already been said it is clear that the architecture of the sarcoma and the bone, as we see them, will not be fashioned by any one of those factors, but will show the effects of a combination of several or all. The utility of any grouping, it appears to me, must be estimated especially from the standpoint of value in

diagnosis, and of value as an aid in remembering the types. A histological classification is practically useless in this regard.

The expansive types are sufficiently characterized by the absence of tendency to early perforation. The diffusely infiltrating growths may be said to remain confined to the interior of the bone because they arise in the deeper layers of the cortex, in the marrow, or in the middle of the spongiosa. That the site of origin must determine this peculiarity of remaining endosteal to a great extent cannot be denied. However, the late perforation, the slow invasion of the compacta, the extensive intramedullary involvement, the striking difference between the development here and in the dissolutive and perforative types—these facts warrant making a separate class of these forms. The fourth group—the dissolutive—presents a marked contrast to the expansive type, and merits therefore the special consideration which it has received. It might be urged that did this variety owe its inception to a focus near the cortex, the perforative endosteal tumor might result. We must grant this to be the case, and that this criticism is not a negligible one. We need hardly pause to discuss the utility of recognizing the sclerosing type; for the diagnostic points brought out by a study of the pathology of these tumors have been dwelt upon elsewhere. As regards the perforative endosteal tumors, can the gross structural changes be explained altogether by the assumption that here, too, the initial process is nearer the periphery than the centre of the bone? It seems that a difference in site of origin cannot be the only factor. For is it not striking that in the case of certain varieties (the diffusely infiltrating—and expansive) a marked resistance is offered by the cortical shell, whereas just here early penetration occurs? It would be only possible to explain the configuration of these tumors by supposing a beginning in the cortex itself. The relative size of extra- and intra-osteal masses will not permit of such an hypothesis in all cases. Those instances in which the extra-osteal tumor is not very much larger than the endosteal mass could hardly start so near the periphery, for the progress without must be much more rapid than within the bone. All in all, it seems best at this juncture to call attention to this variety by means of special grouping, leaving the final adjudication of the admissibility of such grouping until more specimens shall have come under observation.

Finally a word as to the peripheral forms. Ribbert includes here all those sarcomas that originate in bone of periosteal origin. Inasmuch as it becomes practically impossible to decide the exact point of origin from the study of the specimens, and a certain latitude of error must be allowed, such a basis for distinguishing the peripheral varieties seems inadequate. From a consideration of my own material and the study of the available data given by Rumpel, it would be best to include in the peripheral class only those neoplasms which show either subperiosteal growth without change in

the bone, or subperiosteal growth with those typical erosive lesions that indicate to us a genesis in the most superficial layers of the cortex.

I wish to express my thanks to Dr. L. Jaches of the Mt. Sinai Hospital for some of the skiagrams utilized in this study, and my appreciation of the admirable work of Rumpel, which has added greatly to our knowledge of the diagnosis of bone sarcomas.

CASES ILLUSTRATING THE ORIGIN OF HYSTERICAL AND PSEUDOHYSTERICAL SYMPTOMS.

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THE cases to be described will, it is hoped, elucidate a thesis which is rapidly gaining adherents, and which I have presented in various aspects in a series of articles upon hysteria.¹ In this is adopted the definition of Babinski that hysterical symptoms include all those, and are nothing but those "susceptible of being produced by suggestion and of being removed by suggestion-persuasion."²

The various corollaries and applications of this principle are developed at length in the aforesaid writings; and the value of the principle as a diagnostic criterion and guide to treatment has also been discussed, but will appear still more concretely in the following cases:

CASE I.—*Electric Shock Palsy.* A girl was brought to Babinski, having become monoplegic upon receiving an electric shock while crossing a tramway line. This seemed like paralysis not caused by suggestion; but after the symptom had been removed by persuasion, further inquiry elicited the fact that the patient had overheard, some months previously, a conversation between some electricians, who were speaking of the dangers arising from electric shocks of the above description. It is evident that upon experiencing the shock there had flashed into the patient's mind a datum learnt from the conversation she had overheard and apparently forgotten, and that this memory furnished the suggestion at the base of the palsy she developed.³

¹ Considerations as to the Nature of Hysteria; Application to a Case, *International Clinics*, vol. iii, 1908; The Status of Hysteria, *N. Y. Med. Jour.*, 1909, January 9; The Trend of the Clinical Concept of Hysteria, *Bost. Med. and Surg. Jour.*, March 26, 1909; The Classification of Our Concepts of Hysteria, *Month. Cyclop.*, March, 1909; The Essential Character of Hysteria *New Orleans Med. Jour.*, June, 1909. The Genesis of Obsessions and Phobias and their Relation to Hysteria. Congress on Abnormal Children, New York, *Medical Record*, 1910.

² *Ma Conception de l'Hysterie* (conference devant l'Internat.), Paris, 1906.

³ *International Clinics*, loc. cit.

It is perfectly clear that the paralysis of this girl existed merely on account of the idea that she could not move her limbs; that is to say, it was a mental (psychic) palsy. This idea was a false one, for, indeed, there was no interference with the neurons which performed limb movements; the idea had been implanted by the suggestion of a long-forgotten memory aroused into consciousness by an exciting stimulus. It was a true case of hysteria.

CASE II.—*Suggestions of Medical Origin.* So, also, was the case of traumatic neurosis cited by Brissaud,⁴ in which the medical expert, Dupinet, who had previously examined the patient, and found him not anesthetic, saw an anesthesia suggested by the want of technical skill of another expert while examining the patient.

This case illustrates one of the origins of suggestions of medical source, faulty technique in examination of the sensibility of the patient, directly suggested that he could not feel.⁵ The question "can you feel?" inevitably arouses the notion that it is possible not to feel, and this, in a state of mental preparedness, such as that of the apprehension aroused by medico-legal examination, affords a powerful suggestion. The evidence that such unskillful suggestions are frequently implanted by physicians who are indiscreet or unaware of the ease with which certain patients acquire false, fixed-ideas, will be found pretty fully presented elsewhere.⁶ The gastric neuroses afford a fecund and illuminating example of this fact.⁷

CASE III⁸—*Typical Hysteria.* A servant girl, aged seventeen years, came to Ballet's clinic at the Hotel Dieu, Paris, on account of somnambulism, fits of anger, great fatigability, loss of appetite, pains in the head, arms, and back, following overwork. After she was taken into his house by the writer, examination showed total insensibility to pin-prick on face, chest, or arms; but she felt deep pressure, and generally allocheirically. In the face, pin-prick was felt as a touch, and localization was uncertain. Cold appeared hot, except on the right hand, where it was indifferent, and on the head. Stereognosis was not impaired. Sensibility to touch was conserved on head and legs. Sense of attitudes only slightly impaired. Allocheiria on abdomen. Reflexes all normal, except that the right plantar was feeble, and the left conjunctival was absent. Watch heard, but imperfectly, especially on the left. Visual field restricted,

⁴ Discussion sur l'Hysterie, Revue neurologique, 1908.

⁵ Le Rôle du Médecin en créant et maintenant par ses Suggestions maladroites les Maladies produit par l'Imagination, Congrès de Lille, 1906, Amer. Med., August, 1908.

⁶ The Traumatic Neurosis and Babinski's Conception of Hysteria. Congr. Internat. d'Accid. Indust., Rome, May, 1909, and Medical Record, October 2, 1909. Also Jour. Abnor. Psychol., July, 1910; The Commonest Cause of Nervous Indigestion, Jour. Abnormal Psychol., February, 1909; Hypnotism Suggestion, Psychotherapeutic, 1891 and 1903; Les Fausses Gastropathes, Press méd., 1906; International Clinics, loc. cit.; Comment je comprends le Mot Hysterie, Bul. méd., 1906.

⁷ The So-called Gastric Neuroses, Old Dom, Jour., Nov., 1908.

⁸ International Clinics, loc. cit.

especially superiorly. Taste and smell subjectively impaired only. Feels very fatigued after the fits, and then has pricking sensations in feet and hands.

The Dreamy State—Distraction. Since then has had "absences," during which something at which she was looking or listening disappeared (accompanied by a feeling of numbness in the head), and did not return until she shook herself awake. At twelve, she fell down unconscious for forty minutes, and had to be carried out of church. After this, she had "absence" two or three times a week and attacks of "rage" daily for two months. These are caused by an idea coming into her head that she must strike someone. "It is more strong than I." Sometimes she does not remember what has occurred during the attack. She confesses to have had "rages" with her parents, and to have gone away in "flights," about which she forgot the details until the morrow, to forget them the following day. Similar attacks occurred with the teacher at school. When she was asked to do a task she had already done, she talked rudely to the teacher, and fought her back when struck in punishment. The same thing occurred in her places of employment, where she constantly fought her fellow servants, and even her mistress occasionally. Even in her second place, where she was so happy, she would sometimes have fits, while alone, of throwing dishes about, with total amnesia afterward. On coming to herself, she thought merely that she had not done right.

The Treatment. After the first treatment by resisted movements, she could feel a prick on the back of the hand. The nature of the disease was explained. She was told to take cold baths and to always move briskly, to practice an erect carriage, loosen her clothing, to breathe deeply, and when tired to rest. Mechanotherapy was imposed; and the stimuli were to be repeated frequently by herself. A light diet, containing few purins, was administered. The suggestion was made in a waking state that she should not walk in her sleep that night. Repose was ordered from 11 to 12.30 o'clock daily. The following night, however, she walked, no suggestion having been given. She reported improved feeling (sensitivity) after the exercises.

Instruction and Persuasion. Treatment and suggestion were again given; and she did not walk the next night. The following day she had an attack of globus hystericus, became very stupid, and refused her bath. Persuasion overcame this, and sensibility returned more rapidly in the afternoon. One day she passed her station when returning on the Metropolitan Railway; she had a feeling of vague fear on doing this, followed by a chilliness and headache. Three days later, the sense of position was impaired in the left hand and arm.

Hypnotism was then commenced.

"F.—you are in a dream." "Yes, sir."

"What do you dream?" No answer.

"Do you dream of a man?" "No."

"Of a woman?" "No."

"Of children?" "Yes."

"You are a child?" "Yes, sir."

"Where are you?" "First day at school. Fought the teacher all the time."

She woke suddenly and spontaneously, with the usual distraught, half sullen look. That the suggestion not to dream was not hypnotic, in the strict sense, was shown by the remembrance of it, and nothing else.

Her dreams were of the dead. She sees her sister, who died when she was four. Dreams of assassination (saw a man assassinated when she was at the age of fifteen). Dreams of wells (at the age of six, fell into a cellar, also into a hole, and cut her face). These dreams frighten her very much; she shakes with fear, perspires sometimes, gives herself a shake and the dream disappears. Of the death, she says it is annoying; she was too young to realize its meaning. The ease with which the symptoms were made to disappear in this case shows the efficacy of skillfully conducted suggestion—for the graduated mechanotherapy is only a means of applying this.⁹

The Explanation. Here is an example of the gradual ascendancy of impulses which interfere with satisfactory adjustment to the environment, in a girl in whom the origin was traced during hypnotism to unpleasant reactions during childhood. The quarrels with her playfellows, the fighting her teacher, the fall down the cellar, the severe cutting of her face, the seeing of the assassination, all furnished idea-complexes tending to perturb the pleasant rhythm of healthy mentality. It is safe to say that had each of these unpleasant emotions been, so to speak, assimilated and related by skillful management to the totality of neural stresses which constitute personality, no hysteria would have manifested itself.

The Pathogenesis. That the anesthetics were in reality constituted by the examinations of Ballet and myself, I have no doubt. The fact that she dropped dishes did not occur because the hand was anesthetic, but because the mind was absent; for an anesthetic hand would have dropped dishes invariably when not controlled by sight, and this was not the case.

The hypersuggestibility was, of course, induced by the absent-mindedness, but the anesthesia was induced by the doctor. The likelihood of this is shown by the fact that neither Bernheim⁹ nor Babinski¹⁰ has found modified sensibility of hysterical type in any patient not previously medically examined. Our case, then, is an

⁹ Loc. cit.

¹⁰ Bernheim, *La Déméribrement de l'hystérie*, Sem. méd., January, 1909.

example of hypersuggestibility, *i.e.*, hysterizability, due to a state of mental distractability perpetuated by dreams,¹¹ and arising from painful emotional experiences in a patient who was never educated to healthy emotional reactions.

CASE IV.—*Hysterical Hemiplegia*. A young married woman some years before had undergone ablation of the appendages at the hands of a gynecologist of international fame, who was stated to have been treating her also for syphilis, on account of a right hemiplegia and aphasia. The symptoms had ceded in about six months, and had not recurred until a few days before I saw the patient. I found her lying in bed totally unable to move the arm or leg, which were, however, flaccid and anesthetic. She suffered no pain, there was no hemianopsia, ataxia, nor trembling. I could, therefore, exclude a lesion near the thalamus, which never causes complete powerlessness and is always accompanied by some of the foregoing symptoms. The anesthesia, at least, was probably, therefore, hysterical; but one must recollect that organic disability is very frequently augmented by additions arising from suggestion of further disability by the mind of the patient and others.

Though the patient expressed inability to sit up, she did so when urged, ostensibly to test the patellar reflexes. The muscles of the abdomen and pelvic girdle were then seen also to contract coördinately, along with their contralaterals, though quite unable to perform ordered movements alone. This never occurs in complete palsy by organic interruption of nerve paths, and was, therefore, a positive sign of hysterical palsy. There was no means of testing the peculiar trepidating and clasping grasp of the truly palsied hand of hemiplegia, nor the "*marche en fauche*," as the patient could neither grasp nor walk. I found no exaggeration of the tendon-jerks of the patella, achilles, triceps, masseter, or radialis; no diminution of the homolateral abdominal reflex, no extension of the great toe on stroking the sole. Both platysmæ contracted normally on forcible depression of the chin. There was no hypotonia; and, lastly, the palsied arm and leg, when suddenly let go after being supported, or gradually lifted, showed distinct contraction upon forced efforts. There was no implication of facial or ocular movements and no dysarthria.

The Physical Diagnosis. A paralysis, flaccid and absolute; an anesthesia, complete and ceasing abruptly at the midline, comprised the whole syndrome. These characters were sufficient to exclude organic hemiplegia¹² in the present attack, and, moreover, made it highly probable that the former attack was incorrectly diagnosed; for it is certain that a relapse of cerebral hemiplegia of vascular origin would have been inevitably accompanied by distinctive objective

¹¹ Die Traumdeutung, 1900, Berlin.

¹² Differential Diagnosis of Functional from Organic Palsies, Hemiplegias, Paralysis Agitans, Occupation and Habit Cramps, and Spasms, Archives of Diagnosis, Autumn, 1908.

signs, especially that of Babinski, which was not the case with this patient.

The Therapeutic Criterion. Were another argument needed, the immediate success of my treatment furnished it; for I told the patient that her hemiplegia was certainly not organic; that it was curable by the education of the movements which I showed her how to make, at first passively; and that on my return visit I expected her to shake hands. The coöperation of the husband, a medical man, was enlisted, by explaining the mechanism of the affection in due course. At my next visit, several days later, the patient shook hands with me, and walked across the room, as she had been doing for several days. The slight remaining weakness, I assured her, would disappear in a few days.

This case was in all probability derived from medical suggestion, perhaps while in the hospital; the second attack was certainly inspired by the memory of the former one.

CASE V.—*A Mythomaniac.* A young girl¹³ was observed by me in Babinski's clinic, in whom for six months one or other pupil was constantly dilated. No one in the family was using mydriatics, but, upon close inquiry, the girl admitted that the manageress of the laundry in which she worked had been using eyedrops, which, however, she declared she had never seen. A little management of the conversation disclosed the fact that on one occasion she had replaced the bottle after seeing her mistress leave it on a bureau. The demonstration was completed by sending for the prescription, which was found to contain sulphate of atropine. It need hardly be added that there was no more hysterical mydriasis.

This case is not one of hysteria, but of deliberate trickery by a girl with mythomaniac¹⁴ tendencies. This condition is simply that of the falsifier, a form of moral degeneracy. It is not uncommon in young girls, sometimes showing itself in the mystification of a haunted house, as in the classic case reported by Grasset.¹⁵

CASE VI.—*A Rural Sensation.* In a small French village one of the houses was looked upon for some time by all as haunted. The spirits were of a troublesome kind, and nearly drove the mother of the family distracted, as the greater part of her time was taken up repairing the havoc made by them. Many times a day the clothes and mattress would be torn off the bed occupied by the grandfather and thrown in great disorder, sometimes upon the floor and sometimes upon the veranda, where, one day, the fifteen-year-old daughter Jeanne, declared she saw a skeleton reclining. This annoyance was continued until the mother devised a plan of tying the clothes and mattress to the bedstead. Every morning, pins, scissors, spoons, knives, etc., were found in Jeanne's bed; and upon one occasion her

¹³ International Clinics, Loc. cit.

¹⁴ La mythomanie, Paris, 1905.

¹⁵ La spiritisme devant la science, Paris, 1904.

hair had been cut off. Mysterious knockings were heard. The family then began to seek information from the spirits, and received answers of "yes" and "no." They inquired if some person who wished them ill were the cause of all the trouble. On receiving an affirmative answer, the mother took Jeanne to see the village wise-woman, who placed a crystal bowl before the girl and told her to tell what she saw in it. After several failures, Jeanne declared that she saw an old woman in the bowl, and described her so well that the mother at once said she knew whom she meant, and took her daughter to the market to see the old woman. Jeanne recognizd her at once. They then returned to their former adviser, who told them they could destroy their enemy's influence by burning a live cat in their house, taking the precaution to fasten securely all the windows and doors and not to allow anyone to leave or enter the place during the proceedings. While this was being done, loud noises were heard outside the house; and the ceremony terminated by Jeanne, who had not been present at the burning of the cat, frightening her family by a *grand crise de nerfs*. Thinking she was dying, they sent for the doctor, who had her immediately removed to a hospital, and with her departed also the spirits.

The hospital report stated that she had not yet menstruated, though subject to frequent epistaxes, and that she declared that she had passed elots of blood by the rectum.

In twenty-five days she had only three more grand convulsive attacks, and several smaller attacks, without loss of consciousness. The fits began by an ovarian aura mounting slowly to the throat; then the respiration stops, the face becomes congested, and she stiffens, with extended limbs. Then begins the clownism, and the extended movements and vociferous and discordant shouts, along with rhythmic movements of the pelvis. There is complete insensibility, and she retains any attitude imposed. The fit lasts ten to twenty minutes, and is followed either by weeping or urination. Examination: Conjunctival and pharyngeal anesthesia. Pressure on ovary produces sensation of strangulation. At the first examination, anesthesia of the left arm and trunk; at the second examination, of the right arm and trunk and the left face; at the third examination, anesthesia of the limbs, except over a zone of 4 cm., like a bracelet round the ankle. A similar bracelet above the left wrist, the rest of the limb being insensitive, as was the right hand, the scalp, the forehead, and the face of the left side. Islands of anesthesia on thorax and abdomen. This topography was very changeable; its distribution was the same to pain and temperature as well as touch (*sic*); but the patient could appreciate the form and recognize objects in her hands, and describe the position of her legs, unless they were crossed, when she declared that the left was the right, and *vice versa* (alloheria). The visual fields were contracted; and, looking with the right eye, she said that red was violet. Hear-

ing, motility, reflexes, and intelligence were normal; but there was dermatographia. The moral sense was greatly enfeebled—"she runs after the young people in the hospital, steals money and objects from them, and lies audaciously, inventing scandalous histories, of which she is the heroine. At night she stands up and taps on the table, saying to the nurse: 'Did you hear? someone is knocking,' as if to make her believe there were spirits." On tonic treatment, the crises disappeared, and her character changed for the better.

A Schematic Psychology—the Subconscious. Grasset, while admitting the element of trickery in the case, asserts that Jeanne was really a hysteric, also believing to be characteristic the capacity to perform acts with the anesthetic hand, and that the allochiria is characteristic also. He also believes that the table tapping (like the mediumship of Eusapia Paladino) was a fraud of an unconscious kind, agreeing with Ochorowicz¹⁶ that "fraud is inseparable from mediumism, just as simulation is inseparable from hypnotism." He explains what he believes to be the validity of such manifestation by the failure of centripetal nerve impulses to arrive at the centre of judgment of contact, and of perception of pain, but that they penetrate to the *polygon*, by which he means the lower centres for coördinating acts which, though unconscious, may be quite complicated.

Before constructing a schema, it would be well to criticise the facts upon which it is based; and, without specifically discussing this case in detail, the facts of this paper will, I believe, show the inadequacy of observations such as this as a foundation for a physiological schema of the nervous centres. For it is not difficult to see that the replies to the questions about her sensibility arose from her habits of lying and indifference; for Grasset had not adopted in his examination precautions upon which Babinski¹⁷ insists. Even had the method of Head¹⁸ been used, a different result would, I believe, have occurred. The girl's morality was such that she said what first came into her head, without thought or care of accuracy. To say that red is violet, is an absurdity for which there is no pathological basis in nerve structure or functions, but for which the psychological basis is easy to find. To recognize objects with a hand which is insensitive to all the component stimuli by which recognition is possible, is a contradiction pathognomonic of dishonesty, either by intent or through indifference. That is not hysteria, except so far as it is determined by the suggestions of an unskillful examination. The evidence for this is not clear, though it is probable. The case is, therefore, one of mythomania, though not quite pure, and the crises were part of the syndrome, although we are not told whether they were removed by suggestion or not. Now, it is prob-

¹⁶ La question de la fraude dans les expériences avec eusapia paladino, Annales des Sciences psychologiques, 1896.

¹⁷ Loc. cit.

¹⁸ Sensations in the Peripheral Nerves of Man, Brain, 1905.

able that to an extent, the environment of skepticism and control, along with the expectation of cure, in which she found herself at the hospital, was a great factor in their disappearance. This, however, was perhaps rather deliberate than from explicit suggestion-persuasion, and it is probable that, had more skepticism been shown and more direct suggestion-persuasion been used after the method of Babinski,¹⁹ the symptoms would have disappeared still more rapidly.

CASE VII.—*Simulated Hysteria and Mental Debility.* A young negro, accused of murdering his wife, was seen in consultation with Dr. Shute, the jail physician, on account of a suspicion that he was a case of dementia præcox. I was informed that some physicians believed him hysterical, and that others thought he was suffering from syphilis of the nervous system. On examination, I found a well developed man, who showed no abnormalities of motility. The knee-jerk was made very violently (the explanation of this will appear); but there was no corresponding excessive reaction on tapping the tendo-achilles, nor was there extension of the great toe when the sole was stroked. The abdominal, cremasteric, and conjunctival reflexes were present and equal.

He was very unwilling to close his eyes for my examination of the sensibility, and when touched by wool on the right side, opened them and jumped in alarm. He stated that he could not feel at all on the left side; but all his responses were made after much delay, and he was evidently suspicious and alarmed. The sense of attitude was not lost, for, though he pretended not to know in what position I had placed his left foot, he imitated that position when asked to do so. He declared that he could not feel the increase as I gradually augmented to 15 kg. my pressure on the left shoulder. As he was unsupported in the upright position, he must have been conscious, at least, of the muscles of the opposite side acting to maintain his attitude. Of course, even had the impulses from the muscles on the affected side been interrupted, as he pretended, the sound side would have detected the pressure; but he persistently declared that he felt nothing at all.

The diagnosis of simulation was clinched by the fact that, though he pretended not to feel a pin-prick anywhere on the left side, yet when I distracted his attention by making him examine some pictures I had brought to elucidate his mental state,²⁰ and jabbed him unexpectedly with a pin in the lower part of the left chest, he not only started violently, but he placed his hand over the spot and first looked down at it and then at me. As I gave no sign, he slowly returned his eyes to the examination of the picture. The visual fields were not contracted.

As to his mental state, though it was apparently very dull, the

¹⁹ Loc. cit.

²⁰ Méthodes de l'examen des malades (dans Bibliothèque de psychol. expérimental), Paris, 1907.

stupidity he affected did not accord with the results of the tests I made. When I asked him how long he had been in jail, he pretended, with a vague stare, not to know, eventually saying: "two—three years—years." (He had only been in a few weeks.)

By adopting a matter-of-fact manner and ignoring his expectations of meeting with the naïf-credulity to which he had evidently been accustomed, I succeeded in learning that he had been footman to a gentleman in the Department of Commerce and Labor, who lived in a hotel, and who kept a white maid and a colored coachman who lived out. He did not admit, however, the remembrance of his name. His intelligence was, thus, of too low a grade even to pretend a tenable amnesia. I then showed him the pictures, in which at first he pretended not to recognize a tree; but later, he saw the absurdity of his first statement, that a man was holding in his hand a stick, when in reality it was a hose, from which water was issuing; for he not only saw the absurdity when told, but detected the break in the hose. My experience shows that not every individual, even of good intelligence, detects this discrepancy. In another case, he recognized that a horse pulling a sled up a hill was not properly hitched, the chain not being taut; this discrepancy is rarely detected by patients. He thus showed a power of perception utterly at variance with the stupidity he alleged to me and to previous observers. Some weeks later, he was said to have contracture of visual fields. On examination, he again alleged hemianesthesia, but I again tripped him up on one occasion, although several methods failed, on account of his previous experiences. However, he ultimately confessed to feeling pinches on the back of his hand. He related various events to me quite clearly and accurately.

Being given the benefit of a doubt, which should not have existed, he was sent to the asylum, and I am informed that now he shows no somatic symptoms, and merely the mental state of belonging to a low type of intelligence, without any psychosis.

I should add that the hemianesthesia presented the characters of the hysterical type,²¹ that is to say: (1) it was absolute, (2) affected all segments equally, (3) and reached the midline exactly. Whether its source was in medical suggestion or simple simulation could not be ascertained, for, of course, the patient did not confess, and the numerous medical examinations which had been made without the precautions upon which Babinski has insisted, afford a strong presumption of suggestion of medical origin, for it is the common source of anesthesia of this type. The exaggeration of the knee-jerks was a voluntary one, and can be easily simulated, as anyone can prove by trying it. This mode of reaction can be detected by an experienced observer. It probably was the result of the interest shown in it at the first examination.

²¹ The Importance of Modifications of the Sensibility in the Diagnosis of Disease. AMER. JOUR. MED. SCI., April, 1909.

The case was clearly, then, one of simulation, from desire to avoid punishment for the crime he had committed. The form in which the symptoms manifested themselves was determined by the faulty technique in previous medical examinations. The fault was similar to that stigmatized by Soury,²² when he criticised Rainaldi's²³ localization of cortical centres in conformity with the symptoms manifested when he tapped different points of the crania of patients during hypnotism. "The symptoms corresponded with the text-books which the different experimenters had read." What the observers had described was the result of their own suggestions.

And so it was in this case, both for the hemianesthesia and the knee-jerk. Moreover, by his mental reaction, the patient did his best to conform to the dementia syndrome which his interlocutors had in mind. But when a precise and rigorous method of examination had been pursued without "*parti pris*," a very different picture presented itself, that of deliberate simulation in an ignorant person of low intelligence.

Many alienists have stated that a simulator is, of necessity, abnormal. While in the strict sense this is true, yet in some cases it is only so on account of a faulty environment, having determined anti-social reactions in a person in himself quite capable of normal social reactions had the environment been healthy. The trouble is sociological rather than medical.

On the other hand, simulation is often performed through imitation, which is a form of suggestion. The best example of this is the psychic contagia so frequently seen in hospitals among the attendants and patients when these are of inferior intellectual grade. The hysterical crises of Charcot's day were a striking example. Nowadays, a case of appendicitis in a women's college will bring twenty girls to the doctor complaining of symptoms which they imitate according to fancy. I need not here insist upon the psychology of imitation, upon which these phenomena depend. They are inextricably intermingled with those of suggestion.²⁴

Again, consciousness is a matter of degree; and a person who imitates or is suggested into a symptom without knowing how or why may be conveniently called a hysteric; he is not clearly conscious of the process by which he believes.²⁵ The simulator, on the other hand, imitates his symptom deliberately and with intent to deceive. The line is not easy to draw; for each, consciously or unconsciously, grasps at every straw by the way in order to fortify and make to prevail his mental pose. Both states are favored by the same mental make-up. Its tendency is toward impressionability without complex coördination, and to facility of judgment without

²² *Un cas d'autosuggestion scientifique*, *Rev. d'Hypnot.*, 1893.

²³ *La localizzazione cerebrale in un caso d'ipnotismo*, *Faligno*, 1891.

²⁴ *La Suggestion*, Paris, 1900.

²⁵ *The Difference between Suggestion and Persuasion*, *Alienist and Neurologist*, May, 1909.

reflection. The state is commonest during the pubescence of young girls, as illustrated in Case III, and is conducted to by faulty education, in conjunction with the tremendous demands for psychic readjustments at puberty.²⁶

What These Cases Teach. Now, the origin of so many of these manifestations in suggestion so often of medical origin should warn physicians against unconsciously influencing susceptible patients to form false ideas as to their health and powers; for these quickly become fixed into an imaginary disease, a psychoneurosis, variously called hysteria, neurasthenia, gastric neurosis, and nervous prostration, in accordance with the preponderance of particular symptoms.

Fallacies of the Lightning Diagnosis, Differential Tests, and Criteria. These terms have been loosely used because of our want of precision in our appreciation and interpretation of neurotic symptoms. A doctor does not expect his first impression of a person's bulk to establish a diagnosis of adiposity; he proceeds to examine whether he is dealing with fat, muscle, myxœdema, or fluid œdema. Similarly, a cough leads to an examination of the chest and of the sputum. But to most clinicians, ready emotionalism of all kinds is at once diagnosed as hysteria; and apparent mental or physical depression or anxiety may be called neurasthenia. Further analyses will soon show that emotional people are the reverse of hysterical, and that many alleged cases of depression are not neurasthenic, but only imagine themselves to be below par, and can be quickly restored by psychotherapy.²⁷ Other cases are emotional because of a dread that they may not be able to perform some act, usual or otherwise. Cases of this kind have created much confusion in the nosological attempt to distinguish the hysterical from the neurasthenic. They are a distinct class, and their various characters have been collected and described by Janet,²⁸ under the name of psychasthenia.

This class comprises: (1) The sufferers from morbid fears (agoraphobia, claustrophobia), etc. This fear may pervade the whole existence, and be independent of particular objects or situations (pantophobia). In such cases the patient suffers from frequent paroxysms of distress and angoisse,²⁹ excited by the least stimulus, and even without apparent stimulus. When severe, these crises, characterized as they are by gasping, palpitation, trembling, perspiration, and pallor, have often been mistaken for hysterical convulsions. They are, however, nothing of the kind, for they cannot be provoked by suggestion, and in the same person do not vary in

²⁶ Adolescence, New York, 1904.

²⁷ The Differential Diagnosis between Neurasthenia and Some Affections of the Nervous System, for Which it is Often Mistaken, Archives of Diagnosis, January, 1909.

²⁸ Les Obsessions et la Psychasthenie, Paris, 1903.

²⁹ Der angst Neurose (in Obsessions and Phobias), Rev. Neurolog., 1895; La Névrose d'Angoisse, Paris, 1899.

character; whereas, the hysterical fit may be made to vary to any degree desired, by the will and at the suggestion of the operator.

(2) The psychasthenic is characterized, too, by the "folie de doute," "delire de toucher," "manie de verification," and various besetments,³⁰ which render his intellectual life miserable and frequently sterile. The gentle Amiel³¹ is the type of this unfortunate diathesis, and his journal will well repay a perusal by those who wish to understand the mentality of a type of patient the want of understanding of which has done much to discredit our profession.

(3) The less intellectual of these patients, instead of forming obsessions, tend to motor agitations, the imperative need to expend the tension of their spirit in movement.³² Facial grimaces are often the sequel of this: torticollis may occur; both of these, however, are usually initiated by peripheral stimulus, as the following cases show.

CASE VIII.³³—*Tic*. Séglas reported a woman, aged fifty years, who, after three years of neurasthenia, suffered intensely and continuously with pain in the neck. This being followed by a cracking sensation, lead to the inclination of her head over the shoulder, which seemed to relieve the sensation. Although at first voluntary, the need of this position soon became irresistible, and eventually she became unconscious of her normal attitude. It was a true *tic*, for the head could be replaced by simply touching the chin.

The pain and crackings were atopaalgic obsession, and she was constantly trying to see if nothing new had happened to her, and coddled her neck with coverings and drugs of all kinds. Her will was very feeble, but she was rapidly ameliorated by treatment, until she became tired of it, when she relapsed.

CASE IX.—The patient, after an alveolodental perioritis, experienced a feeling of discomfort in the articulation of the lower jaw; and, interpreting the sensation as a new and grave symptom of his malady, forthwith proceeded to investigate its development, by playing with his maxilla. Then ensued a perfect debauch of masticatory movements, in which agreeable repetition of every conceivable grimace was joined to protrusion and retraction of the jaw in the search of articular cracks. He became so wholly preoccupied with this *tic* of mastication that ere long he had begun to pinch the mucous membrane in the inside of the right cheek, between the hindmost molars, and this fresh object of absorbing attention, in its turn, led quickly to some excoriation of the mucosa on both sides. These abrasions were not given time to repair, a suppuration followed, and paved the way for an attack of infective stomatitis, with pain, fever, and malaise, necessitating the application of the thermocautery to the ulcerated areas for its relief.³⁴

³⁰ Obsession et Impulsions, Paris, 1903.

³¹ Journal Intime.

³² Les Tics et leurs Traitement, Paris, 1901.

³³ Un Cas de Torticollis mentale, Rev. Neurolog., 1901; cited by Cruchet in Trait de Torticollis, Paris, 1907.

³⁴ Loc. cit.

It is very evident that, although serious organic lesions occurred in this case, they originated from the purposive movements voluntarily inaugurated, although they passed out of the patient's control on account of his weak will. The psychogenesis is manifest, as is the beginning in a sensation of discomfort and the desire to remove it. The movements were, however, unnecessary and ill-timed; it was a true *tic*.

Dromomania and Dipsomania. But a general motor agitation may occur, and take the form of restless pacing in a room, and aimless wandering over the fields: the *wanderlust* of many a vagabond is nothing but the uncontrollable impulsion of his psychasthenic constitution.³⁵ Some types of *fugues* arise from the same cause,³⁶ a feeling of discontent pushing their victim away from home. This same feeling is at the root of many a dipsomania.³⁷ The moral suffering of these patients is well illustrated by the girl, ignorant of the charms of alcohol, who used to pour boiling water upon her naked feet from which to derive a sensation powerful enough to banish her mental depression.³⁸

Such, then, is the psychasthenic, in no sense suggestible, fully conscious of his deficiencies, and, aided by patience and sympathy, able to explain them in his rather imprecise way; doubtful of himself, and never fixedly deluded, as is the hysteric.

The latter is merely an individual of exalted suggestibility, who easily comes to believe, and does so firmly, whatever idea is implanted upon his too credulous consciousness. He readily acts in conformity with the suggestion he has acquired. He is uncritical and impulsive; he is commoner among the uninstructed and the easygoing and easy-thinking.³⁹ Arising in suggestions, these symptoms themselves may be removed by suggestion-persuasion. But the mental foundation upon which they arise requires for its amelioration a development by re-education.⁴⁰ The doctor must become schoolmaster upon occasions; he must be philosopher, counsellor, and friend of the moral life of his patient.

Only neurasthenia is left; and this is in reality not a psychic, but a somatic disease, or rather syndrome, arising from many different causes,⁴¹ among which may be enumerated visceral ptosis, perturbations of thyroid or other secretions, faulty respiratory attitudes,

³⁵ *Le juif errant à la Salpêtrière*, Paris, 1891.

³⁶ *Archives de Neurologie*, January, 1907.

³⁷ *The Psychological Bases of Incubriety*, *New York Med. Jour.*, April, 1909; also *U. S. Senate Bulletin*, 48.

³⁸ *Les oscillations du niveau mental*, *Congrès de Psychologie de Rome*, 1904.

³⁹ *The Origin of Tics and Hysterical Symptoms*, *Virginia Semi-Monthly*, September, 1909; also *Southern Med. Jour.*, August; also *Month. Cyclop.*, January, 1910.

⁴⁰ *L'Education rationnelle de la volonté*, Paris, 1904; *Isolement et Psychothérapie*, Paris, 1904.

⁴¹ *Differential Diagnosis of Neurasthenia from Affections for which it is Often Mistaken*, *Arch. of Diag.*, January, 1909; also *Charlotte Med. Jour.*, June, 1909; *The Blues*, *New York*, 1905.

pelvic and hepatic congestions, and the auto-intoxications ensuing thereupon, and, finally, perverted metabolism. There is another source in the heredity of the constitution—"born tired"—but these cases are not very common.

CONCLUSION. I have purposely not entered into questions of heredity, family history, previous history of the patient, nor the complete physical examination of any of the cases cited, as I have wished to confine myself to the essentials of each case, and that only in so far as they illustrate the thesis of the paper, the object of which is to present a clear picture of what should be understood by hysteria, and to show the criteria by which a precise differentiation is possible from pseudohysteria, whether mythomantic, psychasthenic, or due to neurasthenia. It is, of course, neither possible to cover the whole ground nor to discuss systematically the therapeutic connotations, for which the interested reader must be referred elsewhere.⁴² Suffice it to say, that in the application of the psychic treatment (for which an essential preliminary is a clear diagnosis, such as the foregoing considerations illustrate) these patients require a rigorous technique. It is even more essential than even in the arts of ophthalmology and surgery, and until this is realized by our profession, we shall continue to be reproached by our want of success in the treatment of psychoneuroses, and shall continue to witness the lamentable vogue attained by christian science, emmanualism, and other extra-mural cults.

PSYCHASTHENIC ATTACKS RESEMBLING EPILEPSY.

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SPILLER,¹ in this country, and Oppenheim,² abroad, have within the last three years called attention in authoritative contributions to the fact that many cases exist that have been for too long diagnosed epilepsy on the one hand and hysteria on the other, but which bear not the stigmas of either. There is need for a widely spread discussion of the disease-forms resembling epilepsy, and especially so at this time, when epilepsy is being made the sponsor for so many pathological mental exhibitions. Especially should the

⁴² *Les Neurasthenies*, Paris, 1903; *Psychotherapy*, Boston Med. and Surg. Jour., 1908; *Psychotherapy*, Monthly Encyclopedia, 1908; *Requisites for the Treatment of the Psychoneuroses*, etc., Month. Cyclop., Jour. Cal. State Med. Jour., Old Dom. Jour., June, 1909; also *Psychotherapy*, a Symposium by several authors, Badger (Boston), 1909.

¹ Discussion at the joint meeting of the Philadelphia and New York Neurological Societies, held in Philadelphia November 24, 1906.

² Jour. f. Psych. u. Neurol., 1905-6, vi.

general practitioner know of these distant relatives of epilepsy. He sees them first, and can thus save the patients so afflicted an immense amount of mental anguish, for the fear of epilepsy haunts most of them.

The cases mentioned by Spiller and Oppenheim comprised a number of individuals who were purely psychasthenic. These people developed attacks resembling the attacks of true epilepsy during the course of their illness. When their cases were analyzed it appeared that though some of the attacks themselves resembled epilepsy, nevertheless the disease picture as a whole did not conform to the type sufficiently to be classed as epilepsy; the course of the disease was different; the character of the attacks themselves differed widely one from another; the cases lacked essential stigmas of epilepsy; moreover, it transpired that the prognosis was good instead of bad as compared with epilepsy.

Previous to Spiller's and Oppenheim's publications, Westphal³ wrote a paper concerning cases in which convulsions occurred as complications. His cases would now be classified under the name psychasthenia. In all the cases recorded the patients had been deeply neuropathic. Most of them had been psychopathic from birth or early life. Many possessed a tainted heredity. Many developed neurasthenic symptoms during the course of their disease. As Spiller brought out, if they were neurasthenic, their neurasthenia was of the grave type. They were of that type which the French writers, especially Janet and Raymond, regard as psychasthenia, owing to their mental abnormalities. In every case the whole history is colored by this condition.

The most obtrusive and interesting symptom is the attack itself—the more terrifying because of the resemblance to epilepsy. Analysis of them brought out the important points of differentiation. It was found that they differed in kind and varied in intensity not only in different cases but also in the same individual. They would at times be characterized by deep unconsciousness without convulsions (simulating the epileptic “dreamy state”). During this there may or may not have been involuntary micturition. If it be present it is explained as the result of a relaxation of the bladder sphincter taking place at a time when the bladder happens to be full, whereas in a true epileptic attack the micturition is due to the spasmodic contraction and relaxation of the sphincters acting in concert with the generalized spasms. On the other hand, the unconsciousness may be accompanied by convulsions and biting of the tongue and rigidity of the pupils. At another time there may be a seeming unconsciousness in which the patient is cognizant of what is transpiring part or all of the time during which the attack

³ Archiv f. Psych., iii, 18 to 72.

is active, but is unable to effect vocal speech, simulating the "stupor period" of epilepsy.

Oppenheim does not admit any resemblance to hysteria cases, but he confesses that a differentiation from true epilepsy is not always easy unless the whole case is analyzed carefully. This seems to be the prime requisite in identifying these cases. In taking analysis, careful weighing of symptoms, appreciation of the disease picture as a whole. In this connection three points to be kept in mind: (1) Though the patient is not in the attack itself cannot at times be distinguished from true epilepsy. (2) "The condition is merely an epileptoid course of a psychasthenia," and the attacks may be few in number. (3) The attacks often vary in character in the same individual. (4) Intelligence and memory do not become impaired by the recurrence of the attacks. (5) The attacks have little value. "The treatment should be mainly mental."

As was said already, Oppenheim maintains the absence of any resemblance in these cases to hysteria. Furthermore, he cites Charcot, that the term hystero-epilepsy is a misnomer. A case so named is an hysteria. He admits, in addition, that a case may be both epilepsy and hysteria in the same individual, but not allow them to be confounded or mingled. As to the cases referred to in this paper, he has this to add: "In my experience there are persons in whom attacks of a nature of an epileptoid type occur. It cannot be denied that they occur spasms (attacks) which seem to be between hysterical and those of an epileptic nature." Two years ago the last publication on this subject appeared, which, to quote Dr. Spiller's paper, identified the disease picture as a nosology.

When Spiller's paper was read the discussion that followed was very instructive. Dr. Charles Dana said he had read it a long time previous time before the New York Academy of Medicine. He called the condition, which he called "para-epilepsy" (this paper has not been published). He agreed with Dr. Spiller as to the disease picture. Thus it has seemed necessary as a reliable and expedient to make a new classification of these cases. It only does it free the patients from the evil stigma which the name epilepsy stamps upon them, and avoids the suggestions associated with any reference to it, but it does not answer the questions of prognosis and treatment.

I believe it is necessary to exercise great care in ruling out hysteria in these cases, even though Oppenheim does not admit a close relationship between them. This is said with due hesitancy in the absence of such authority. But a number of these cases seem more like hysteria than to epilepsy, and yet do not exhibit sufficient grounds to warrant us in placing them under that head.

As to the cases herewith recorded, it seemed to me no

class the attacks as "psychasthenic attacks," in line with Spiller's dictum. In fact, two of them were seen by him with me, and he confirmed the diagnosis.

CASE I.—Mrs. B., aged forty-one years.

Family History. Her father died of senile dementia at seventy-nine years. She has one daughter who developed tuberculosis at seventeen years of age.

Personal History. Her history has been eventful in the matter of etiological data; married at twenty-two years of age, she had five pregnancies in eight years. Her first and last children were born alive, the others being removed by abortions that were performed by advice of her physician, who said her uterus was undeveloped. The first child was born at term and weighed only two pounds and nine ounces. She is the one that still lives. The last child lived a little over two months. For four months previous to its birth the mother was in sad straits, owing to grave œdema; she was so waterlogged that her appearance excited the curiosity of friends, who had her carried to a grocer's and weighed. Her weight was 310 pounds. A year and a half later she was operated upon for salpingitis, both tubes and ovaries being removed and the uterus left in situ.

The Attacks: Shortly after she began to walk about she had "fainting spells," preceded by intense flushing of the face. "Everything would get black," and she would fall wherever she happened to be; once she fell down eight steps from a high doorway, breaking a number of bones; again, from the second to the first floor down a number of steps. The attacks were always preceded by tinnitus and blindness. (It seemed to me in analyzing these attacks that they were the sequence of intensified nervous symptoms following upon the heels of the removal of her ovaries, and were the expression of nervous overflow.) During the attack she was often unconscious, but not always. In the latter kind she seemed so, and could not speak—"everything seemed far off." At times her eyes would be open and glassy and at others closed. Her nervous system was in such a bad condition that she easily acquired the habit of these exhibitions, and they recurred very frequently. For nine years their character was about the same. She was operated upon for an appendicitis. After this there were two distinct types of attacks—one in which she would be conscious, but unable to move or speak. She called these her "flushed" attacks. The other would be ushered in by intense fear, tachycardia, pallid face, and then total unconsciousness. After the former kind she would recover quickly and resume her occupations. After the latter she experienced marked air hunger, even to the extent of tearing at her left breast (it was thought to be angina pectoris). These terrifying symptoms were always followed and relieved by belching large quantities of gas. (After the flushed attacks she never belched.) After several years

of this she was, naturally, reduced to a pitiable state of mind and body. She was intensely neurasthenic, complained of constipation that was obstinate, and was made miserable by flatulence and meteorism. She showed a large excess of indican in her urine. Treatment resulted in a cure that lasted for years (and as long as she was under observation). It consisted in correcting her intestinal condition and in psychotherapeutic measures, extending over several months.

CASE II.—Mrs. S., aged thirty-four years.

Family History. Her mother died of cancer, and one sister of tuberculosis. Her three living children are very healthy in appearance, but the eldest, aged seven years, gives a history of convulsions, obstinately elevated temperature, constant and hacking cough, and spells of vomiting. Inasmuch as there have been several attacks of the true grand mal type in the child of a mother who suffered with attacks more or less resembling epilepsy, her case is interesting by comparison, and I will insert it briefly. While the child was yet in utero the mother was infected with malaria, which lasted for months after the child's birth and during the whole period of breast feeding. With this bit of history as a clue, the child's blood was examined and the expected malarial element found. An appropriate exhibition of quinine and arsenic gave a beautiful exhibition of therapeutic efficiency that was "dramatic." At once the temperature became normal, the hacking cough ceased, the vomiting stopped (it was due, I think, to the cough), and she had no more convulsions. I saw one similar case (minus the convulsions) with Dr. J. W. McConnell, of Philadelphia, some years ago, in which the results were just as exact. (I look upon my case as one of symptomatic epilepsy.) As for the mother, when a child she was wont to have "spasms." These appeared in her ninth year and lasted to her fourteenth year. She says she was unconscious during them. She was married at twenty-five years of age, and ever since has been subject to fits of the "blues," periods of mental depression, spells of crying, and general nervousness. Her general health has been good except the malarial infection referred to above.

The Attacks: Her present trouble began about one year ago, when she saw an acquaintance killed by a train. She at once felt a severe nervous shock, that merged into numbness and heaviness of both legs and a feeling of faintness. She called out. A neighbor ran to her and found her lying on the floor seemingly unconscious; she says she knew in a vague way what was going on, but could not speak. A physician was called, who added a pathological suggestion to her already pathologically increased suggestibility by telling her she was in a precarious condition and that she might expect sudden death at any moment! Since the first attack at every menstrual period she has had a severe headache with vomiting, followed by the attack in which she falls to the floor unconscious. This woman's

history suggests hysteria, additional data being that at different times three stigmata appeared—i. e., diplopia with one eye shut (of this I am not positive), hemihyesthesia, hysterical color fields. But none of these have been persistent, were transitory, and were, I believe, the results of suggestion. She complained of obstinate constipation, flatulence, and periods of vomiting, and her urine showed excess of indican. In this case the prognosis was good and was amply borne out by the results of treatment, consisting of thorough regulation of the excretions with persistent psychotherapy.

CASE III.—Miss S., aged twenty-six years.

Family History. Her mother died after three "strokes" of apoplexy; she weighed 200 pounds, and probably suffered with arteriosclerosis. Little is known of the father, and he seems to have been a "ne'er do well."

Personal History. Her mother told her she had "spasms" when a baby. Before she was nine years old she had scarlet fever, measles, diphtheria, and typhoid infections. At twelve years of age she went to work in a drygoods store, and had to work very hard. It will be noted that up to adolescence she had experienced enough attacks upon her vitality to cause serious inroads upon the supply. In fact, for the last five years she has been subject to fainting spells whenever suddenly alarmed or shocked. She says her feelings are either "away up or away down."

The Attacks: Since her mother's death, two years ago, she has experienced attacks differing in kind from the above. Their onset is generally near a menstrual period (as in Case II). Prodromal symptoms are feelings of general nervousness, and she becomes sensitive to an extreme. Generally fond of people, at these times she shuns them. She suspects that she is being looked down upon by her fellows on account of her lack of accomplishments. The attack itself is preceeded by a sense of mental heaviness and lassitude, during which, if she sleeps, she may at times ward it off for a time. The attacks are not all alike. Some of them are ushered in by a scream, most of them by an almost unbearable headache and backache. The latter she calls "light attacks." I saw one of this kind; she had had headache and mental depression for a day, and as she was seated in a chair relating her feelings she grew limp and fell to one side. She was unconscious of painful stimuli, but at times would grit her teeth and frown. There were a few intentional movements of the arms, but no convulsive movements. The attack lasted about fifteen minutes, and then she gradually came to herself. After it she complained of physical weariness. In several attacks she has passed urine involuntarily, and there have been many attacks characterized by convulsions. She generally has a crying spell after the attacks, and then feels better, though weak. She is distinctly hysteroid for one or more days preceding the attack, inasmuch as her conduct is at this time "characterized by abnormal activity of the emotional

perceptions" (Zeihen); but at other times she is either mildly psychasthenic or seemingly elated. She shows no other stigma of hysteria than the emotional element. Her general physical condition is excellent.

CASE IV.—Miss W., aged thirty years; schoolteacher.

Family History. Her father died of tuberculosis. One brother has tuberculosis. One sister is decidedly neurasthenic. There are nine children, and none of them is robust.

Personal History. From childhood she has been inclined to overdo, has never conserved her energies, but rather the reverse. Her temperament has been headstrong, obstinate, and ambitious. Ever since her menses were established she has suffered with dysmenorrhœa and intense headaches at these periods. Twelve years ago, at the time of her father's death, she had an attack similar to the ones she now complains of. For years she has had a great deal of headache of the neurasthenic type, at the back of the head and neck, and coming when she was tired. She has been a teacher for a number of years, and at the end of every school year she has been completely fagged. Six years ago she had a collapse after taking the teacher's examination. At that time she was in a semiconscious state for twenty-four hours, and for two weeks was unable to do much. She has never had any severe illnesses, and has been considered the strong one of the family.

The Attacks: For some time subsequent to the end of the last school year she had been very irritable, querulous, unable to make her brain work satisfactorily, easily tired. One day after a night of headache, she remained in bed, feeling nervous and unstrung. This feeling increased until she felt she "could not stand it any longer." Her mother's coming into her room caused her to cry out, "I think I am going crazy!" This was said involuntarily. The tension seemed to be too great, and she flung her hands above her head and fell from the bed to the floor unconscious. Two days later the same thing occurred. In all, she has had five attacks. They are characterized by prodromal feelings of great fear, tachycardia, and an explosive utterance of the words, "I am going crazy!" She says the words are involuntary and as though some one else had said them. There are no convulsive movements except those of respiration. The attacks may be brought on by fright or shock; I saw one that was induced by a sharp clang of a bell. It seemed to be a letting go of the state of "awareness," due to the asthenic condition of her nerve centres.

Personal Examination. Examination shows her to be thin but wiry. Her hands and feet chill easily. The heart and lungs are normal. The urine is normal except that there is excess of indican. She is constipated. Her sleep is much interfered with, though this is not her usual habit. The reflexes are exaggerated. She does not show any sign of hysteria, but she does show markedly the evidences of

grave neurasthenia, together with the mental abnormalities that go to make psychasthenia. She fairly leaks nervous energy. Her mental activity is almost a delirium at times; her thoughts become a "procession of freaks that go galloping along, pricking me as they go."

SUMMARY. All of these patients are females with an asthenic mental condition that is unquestionable. Ignoring the attacks themselves, every case would be diagnosticated psychasthenia. They all feared epilepsy or insanity. The assurance that these fears were groundless was a great boon. The treatment consisted in mental and physical hygiene together with rest or exercise, as seemed to be indicated.

A FATALITY FOLLOWING THE REMOVAL OF TONSILS AND AN ADENOID GROWTH.¹

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EVERY one is aware that there are many unreported deaths occurring in connection with tonsil and adenoid work. Within a few weeks subsequent to the death reported in this paper, the newspapers of Philadelphia contained the account of a case of a boy who had died while on the table during an operation for the removal of his tonsils. The newspapers said the child was a hemophiliac, and that death occurred from uncontrollable hemorrhage. The names of the physicians in attendance upon the case were not given, and the case has never been reported, so far as I am aware, before any of the medical societies in Philadelphia.

The fact that these cases are not reported is to my mind one of the reasons why not only the laity, but a great majority of general practitioners regard tonsil and adenoid work as comparatively safe, and the operation is almost universally considered of insignificant importance. It is frequently a matter of great difficulty to persuade the patient or his family that the operation is of sufficient danger to warrant its performance in the hospital, and the family physician frequently aids and abets them in urging the operator to do it at the patient's home.

During the past twelve months I have operated upon 466 patients for the removal of adenoid growths in the nasopharynx, diseased faucial tonsils, or both. Of these cases, in 393 I removed both tonsils and adenoids, in 46 cases I removed the tonsils alone, and in 27

¹ Read at a meeting of the Section on Otology and Laryngology of the New York Academy of Medicine, January 26, 1910.

adenoids alone. I have long since felt that in the majority of instances these cases should be operated upon only in hospitals. Of the cases I operated upon last year, I did 455 in hospitals, and but 7 at the home of the patients. In 4 cases I dissected out the tonsils in my office, using cocaine locally as an anesthetic. In 345 cases I used ether as an anesthetic, preceded by a few whiffs of ethyl chloride. In 112 cases the anesthetic was ether alone. I operated upon but 9 cases with cocaine anesthesia. I believe that ether is the safest general anesthetic to use in these cases. I have yet to learn of a death during a tonsil and adenoid operation which could be attributed solely to ether, and I have personal knowledge of 3 cases in which chloroform was administered and death occurred before anything could have been done to produce a fatal result aside from the administration of the anesthetic. I have generally had the ether preceded by a few whiffs of ethyl chloride to overcome the first disagreeable effects of the ether. Ethyl chloride possesses a great disadvantage in the fact that if given in any quantity it produces a rigidity of the jaw which greatly interferes with keeping the patient's mouth open. I do not like, even in adults, to remove tonsils under local anesthesia, as I think with a general anesthetic the operation can be done much more thoroughly, and if properly administered, I think ether is so perfectly safe that I have but little fear of any bad results.

Except in cases in which I am absolutely certain that my directions regarding the preparation for the operation will be rigidly carried out, I require patients to enter the hospital the day before the operation, and they are always required to remain in the hospital for at least twenty-four hours and longer, if there is any elevation in their temperature or other symptoms requiring it. Especially in ward cases, I think it of importance to keep the child in the hospital under observation until the danger of secondary hemorrhage or infection may be regarded as over.

As to the method of operation, I believe that the consensus of opinion is now so strongly in favor of complete ablation of the tonsils that there are very few cases of the less complete operation undertaken by a competent laryngologist. There still remains considerable difference of opinion as to whether the entire capsule of the tonsil should be removed, or whether we shall content ourselves with removing the gland from the capsule. My own method of work depends entirely upon the individual case.

For the removal of adenoid growths in the nasopharynx I use practically altogether the French adenoid forceps, occasionally supplementing them with a Gottstein curette.

When using a general anesthetic, I always operate with the patient in the recumbent position, with the head a little lower than the body. I believe this lessens the danger attendant upon the use of the anesthetic, and obviates, as far as is possible, the chance of

fragments of tissue or blood getting into the larynx. I have yet to see a case of inspiration pneumonia or obstruction from tissue in the larynx.

The fatal case which I have to report was a particularly painful and puzzling one. The following are the facts regarding it:

On September 27, 1909, the patient, C. W., a little girl, aged three and one-half years, was brought to my office by her mother, who gave me the following history:

She said that until one year ago the child had apparently been perfectly healthy, but during the past two months suffered from frequent coughs and colds, sleeping with her mouth constantly open at night. Her mother said what she chiefly noticed about the child was her restlessness during sleep, and the fact that she had become languid and had very little appetite.

The child was apparently a perfectly normal little girl, of the average size and healthy appearance, except for a somewhat sallow complexion. This her mother attributed to frequent bilious attacks, from which the child suffered and for which she had been in the habit of giving calomel. Examination revealed a pair of rather large-sized tonsils, with wide-open crypts, and some cheesy material in some of the crypts of both tonsils. Upon digital examination I found a large soft mass of adenoid tissue, pretty completely blocking the nasopharynx. The child's heart and lungs were normal.

She was admitted to the Pennsylvania Hospital on September 30, 1909, at about ten o'clock in the morning. At one o'clock she was anesthetized. The anesthetization was started with ethyl chloride and followed by ether given by the drop method until unconsciousness had been induced, when the anesthetizer used a vaporizing apparatus very similar to that used by Dr. Pynehon, of Chicago, passing the ether vapor through a wash bottle, and introducing it into the system by means of a metal mouthpiece. There was a great deal of mucus in the nose and throat throughout the anesthetization and the operation. The total amount of ether used was three ounces.

I loosened up the tonsils on both sides with the dry dissector. The left tonsil I removed by digital manipulation and dissection with a pair of seissors. The right tonsil I removed with a small guillotine, after having freed it from the surrounding tissues. I then removed the adenoid with a pair of French adenoid forceps. There was considerable bleeding following the removal of the adenoid, so that when the child was removed from the table I asked the resident physician, who had assisted me, to have her watched, although at the termination of the operation I had a perfect view of her throat, and there was no active bleeding from the nasopharynx or the pharynx. The anesthetization lasted fourteen minutes, and the child was on the table about ten minutes, when she was returned to her private room in the hospital. I saw her about thirty minutes later, when she was

coming out of the ether. She had vomited a small quantity of blood, evidently from her stomach. Her pulse was good, her skin felt dry and warm, and her temperature was practically normal. About 4.30 in the afternoon the resident examined her throat and said there was apparently no bleeding. At 5.30 one of the nurses noticed that her color was not very good, and called the attention of the resident, who agreed with her, but thought it was no more than the peculiar sallowness which had been present before the operation. At that time he examined her again and could find no evidence of bleeding. Her pulse was good and she seemed in good condition. About 6.30 the child's temperature had risen to 100° , her respiration to 36, and the pulse rate 156. The resident telephoned me at 7 P.M., and told me that she seemed in poor condition. I told him to examine her carefully and see if he could find any bleeding, and that I would visit her at once. Before I had time to leave the house, I was called again and informed that the child had stopped breathing. I told the resident to do a tracheotomy and to inject salt solution into a vein. I went at once to the hospital, and upon arriving found that the child was dead. The trachea had been opened and an intravenous injection of salt solution given, but she never responded.

Dr. Bradbury, the chief resident physician, informed me that, acting under my instructions, he had inserted the tongue depressor in the child's mouth in an effort to see if she was bleeding. The contact of the tongue depressor caused her to gag, and she vomited, bringing up no blood, however. Apparently, something occluded her larynx at the time of vomiting and her respiration ceased. Dr. Bradbury pulled her tongue forward to see if there was any vomitus obstructing respiration. After opening the trachea, nothing could be found obstructing its caliber, and it contained no blood. No autopsy was obtainable.

This case presents features which, to my mind, render it practically certain that the fatal result was due to the condition known as status lymphaticus. The child's death was certainly not due to hemorrhage, nor could it be attributed to the method of administration of the anesthetic, nor the quantity used. As to status lymphaticus, so little is really known about it that unless an autopsy had been obtained and an enlarged thymus gland found, it would be impossible to state positively that this condition had been the cause of the child's death.

In a most interesting article, W. Humes Roberts² states that in nearly all the cases in which status lymphaticus has been demonstrated at autopsy, enlargement of the thymus gland has been found. He attributes the deaths in the cases which he reports to the anesthetic, which may, of course, be considered as the chief

² The Status Lymphaticus, with Particular Reference to Anesthesia in Tonsil and Adenoid Operations, *Laryngoscope*, September, 1908.

source of danger in these cases, but he quotes from Blumer³ the following statement, which bears on the case I report.

"Individuals who are the subjects of status lymphaticus are born with an instability of the mechanism regulating the so-called 'horror-toxicus,' at any rate, so far as the lymphatic apparatus is concerned, so that they are subject to intermittent attacks of lymphotoxemia which may lead to reflex phenomena of various kinds, or may cause death from cardiac paralysis. During the attacks of lymphotoxemia such individuals are especially susceptible to the action of bacterial or chemical poisons, and also to physical and psychical shocks, which at these times may cause their death under circumstances which would be trivial to a normal individual."

A. S. Warthin,⁴ discussing the relation between thymic death and status lymphaticus says:

"It is, of course, evident that the condition of thymic death is that classed by many writers as the chief feature of status lymphaticus. It is, however, a question as to whether the latter represents a definite primary pathological entity. It is much more probable that the clinical and pathological features usually regarded as characteristic of lymphatism constitute a cachectic complex secondary perhaps to a number of primary morbid processes, such as syphilis, rachitis, some latent infection, auto-intoxication, etc., that are characterized by an excessive demand upon the lymphoid and myeloid tissues of the body. At a certain stage in the process the lymph nodes may be enlarged, and it is to this stage that the term status lymphaticus is usually applied. The microscopic examination of the enlarged nodes may show, however, the same condition of lymphoid exhaustion found in those of thymic death in which the nodes are small. The thymic enlargement is most probably to be regarded as a purely compensatory condition secondary to some primary lymphotoxic or myelotoxic process. The sudden death in status lymphaticus is dependent primarily and wholly upon the thymic enlargement, and the latter condition becomes, therefore, the most important feature clinically. Moreover, thymic enlargement leading to thymic death may exist without any other clinical features ascribed to the status lymphaticus. Nevertheless, the latter term serves a very good function in designating the cachectic complex of thymic enlargement associated with adenoids, enlarged tonsils, enlargement of the lymph glands, rachitis, etc."

³ Johns Hopkins Hospital Bulletin, October, 1903, xiv, No. 151.

⁴ Osler's Modern Medicine, vol. iv.

METABOLISM AFTER PARATHYROIDECTOMY.

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NUMEROUS investigations of the parathyroid gland during the past few years have established the important fact that, in all animals observed, the parathyroid is distinctly separate from the thyroid in function, and that, whereas the complete removal of the thyroid tissue alone is followed by a series of symptoms appearing slowly and leading to a cachexia, complete parathyroidectomy causes the sudden appearance of the well-known syndrome of tetany parathyreopriva, in which the inuscular twitchings and rigidity, with tachypnoea, are the most evident manifestations. This tetany is of nervous origin. It can be relieved immediately, although temporarily, (1) by bleeding with subsequent transfusion of normal blood or infusion of normal saline solution; (2) by an injection of an emulsion of parathyroid glands or by injection of the nucleoprotein of these glands; and (3) by the injection of a soluble salt of calcium, or perhaps somewhat less readily by injection of salts of the metals belonging to the same chemical group—strontium, magnesium, and barium. The permanent cure of the condition can be secured only by the transplantation of parathyroid tissue.

A successful explanation of these experimental results, of which I have given only a brief outline, has been difficult, and it has been thought by some investigators that perhaps, in studies of the metabolic changes following parathyroidectomy, facts might be discovered which would render the interpretation less obscure. The observations so far recorded may be divided into three groups: (1) Changes in the carbohydrate metabolism; (2) variations in the salt elimination; and (3) alterations in the protein metabolism.

1. CHANGES IN THE CARBOHYDRATE METABOLISM. The results of experiment along this line are as yet rather meagre, but it has been shown (R. Hirsch¹) that while there is a distinct decrease in the assimilation limit for dextrose given by the mouth in dogs after complete thyroparathyroidectomy, there is no such effect produced after thyroidectomy if the parathyroids are undisturbed. Thyroparathyroidectomy also produces a decreased capacity for the utilization of dextrose introduced subcutaneously (Underhill and Saiki²) and this does not occur after thyroidectomy alone (Underhill and Hilditch³). In addition, the diminished power to assimilate dextrose observed in dogs on removal of three parathyroids is

¹ Zeitschr. f. exp. Path. u. Therapie, 1906, iii, 393; *ibid.*, 1908, v, 223.

² Jour. Biol. Chem., 1908, v, 225.

³ Amer. Jour. Phys., 1909, xxv, 2, 66.

not increased by the additional removal of one thyroid lobe (Eppinger, Falta, and Rudinger⁴).

These observations indicate that the parathyroids are perhaps associated with the metabolism of carbohydrates, but the nature of their influence cannot be stated.

2. VARIATIONS IN THE SALT ELIMINATION. Attention to this phase of investigation, particularly with respect to the calcium salts, was suggested by the known relation existing between these salts and certain forms of muscle irritability, as shown by the observations of J. Loeb,⁵ that abnormal muscular twitchings and contractions may be brought about in an organism by the reduction in the proportion of calcium (or magnesium) in the muscles or blood, and that the injection into the animal body of any salt liable to precipitate calcium causes twitchings of the muscles; and likewise MacCallum's⁶ observation of the wonderful effect of calcium salts on the tetany following removal of the parathyroids. It has been shown also that in cases of tetany in children the output of urinary calcium is increased (Oddo and Sarles⁷), that calcium chloride given by the mouth in this condition is followed by improvement (Netter⁸), and that there is a lessened calcium content of the brain (Quest⁹). The first experiments were those of MacCallum and Voegtlin,¹⁰ in which they found an increased elimination of calcium in the urine and feces of fasting parathyroidectomized dogs during tetany. They found also that the calcium content of the brain and blood of dogs with tetany was less than that of normal dogs. My own experiments¹¹ gave results somewhat at variance with the above, as I was unable to detect an increase in the calcium excretion after parathyroidectomy, nor could I confirm the finding of a decreased calcium content of the brains of dogs dead from tetany. The brains I examined showed a slightly greater content of calcium than those of normal dogs, and the results were more in accord with those of Parhon, Dumitresco, and Nissipesco¹² who found the calcium of the nerve centres after thyroparathyroidectomy greater in amount than in normal animals. In my experiments, however, there was found a marked and constant increase in the urinary excretion of magnesium which appeared before any symptoms of tetany could be detected, and continued until the death of the animal.

I have been unable to find any observations of the excretion of sodium and potassium in this condition.

⁴ Zeitsch. f. klin. Med., 1909, lxxviii, 1.

⁵ Univ. of Chicago Decennial Publications, 1902, x, 3.

⁶ Jour. Exp. Med., 1909, xi, 1.

⁷ Quoted by Netter (8).

⁸ Comp. rend. de la Soc. de biol., 1907, lxii, 376.

⁹ Jahrb. f. Kinderheilk., 1905, lxi, 114; Wien. klin. Woch., 1906, xix, 830.

¹⁰ Loc. cit.

¹¹ Proceedings of the Society for Exper. Biol. and Med., 1909, vii, 13; and Jour. Exp. Med., 1910, xii, No. 1.

¹² Compt. rend. de la Soc. de biol., 1909, 792.

3. ALTERATIONS IN THE PROTEIN METABOLISM. Verstraeten and Vanderlinden,¹³ in 1894, observed that animals developed tetany earlier and in a more violent form when kept on a meat diet, but no satisfactory studies of the nitrogenous urinary products were made until those of MacCallum and Voegtlin¹⁴ appeared. These investigators found an increased excretion of total nitrogen and ammonia, with an increased ammonia ratio in the urine of fasting parathyroidectomized dogs with tetany. Berkeley and Beebe¹⁵ state that they have confirmed this increase in the urinary ammonia. Underhill and Saiki¹⁶ also found a higher ammonia content in the urine of dogs after thyroparathyroidectomy, but not after thyroidectomy alone.¹⁷ I have been able to confirm the increased content of nitrogen and of ammonia in the urine after parathyroidectomy. The excretion of creatinin is practically unaffected after parathyroidectomy.

The older view of the functions of the parathyroid glands and the changes following their removal is that there are certain toxins—probably waste products of normal metabolism—which are physiologically neutralized or in some way rendered innocuous by the parathyroid secretion; in the absence of this secretion these “toxins” cause an intoxication with the accompanying phenomena of tetany, etc. The good effect on the tetany of bleeding, which presumably reduces the circulating toxin, or of injections of parathyroid extract, or nectoprotein, which presumably neutralizes it, support this explanation. A later and somewhat different hypothesis is that of Silvestri, MacCallum, and others who think the tetany is a result of a hypocalcification of the nerve centres. They assume that in the absence of parathyroid secretion substances arise, possibly of an acid nature, which can combine with calcium, abstract it from the tissues, and cause its excretion. The moderating influence normally exerted by calcium salts on the nerve cells being thus to a certain extent removed, there ensues a hyperexcitability of the nervous system with the appearance of tetany, which is relieved by a restoration of calcium to the impoverished tissues. This hypothesis is supported to a certain extent by the observations, which, however, I have been unable to confirm, of an increased excretion of calcium in the urine and the diminished calcium content of the blood and brain in tetany. On the contrary, it has been urged that venesection, with the presumable removal of yet more calcium, nevertheless allays the tetany. It is possible that my observation of the increased magnesium excretion in tetany is in some way connected with this hyperexcitability of the nervous system, since this metal also has a moderating influence on the nerve cells. Both calcium and magnesium exert a depressant action, and if the withdrawal

¹³ *Mem. couronnés de l'Acad. royale de méd. de Belgique*, 1894, xiii, 1.

¹⁴ *Loc. cit.*

¹⁵ *Jour. Med. Research*, 1909, xx, 149.

¹⁶ *Loc. cit.*

¹⁷ *Loc. cit.*

of either or both of them is related to the tetany, the action is probably a removal of the inhibitory influence which they normally exert, and the resulting hyperexcitability is due to the stimulation of some other factor physiologically held in check by the calcium and magnesium. Therefore, if changes in the salt content of the nerve centres are implicated in the production of tetany, the changes in the absolute content are probably not so important as the changes in proportion of the various salts to one another. So that analyses of brains of dogs with tetany which show a slight decrease or a slight increase in calcium or magnesium as compared with normal brains are probably of less value than analyses would be which showed the relative proportion existing between the various salts. Unfortunately, I have been unable to find a record of any such estimations, and my own observations are as yet incomplete.

Although a disturbance in the salt balance may account for the appearance of the tetany, there is little evidence to indicate that inorganic equilibrium is controlled directly by the parathyroids, or that the symptom of tetany is other than secondary to some more serious metabolic disturbance resulting from the parathyroid insufficiency.

Reference has been made to the increased urinary excretion of magnesium in my experiments which was apparent before the animal developed tetany. The increase in the urinary ammonia and total nitrogen was also noticeable before the tetany appeared. In addition, it has been repeatedly observed that some animals after parathyroidectomy sink into a dull, listless condition and die without the peculiar muscular symptoms having appeared. One of my dogs, in which this condition was noted, showed the same increase in the nitrogen and ammonia that characterized the animals with marked tetany. And finally, dogs can be kept comparatively free from tetany by the administration of parathyroid nucleoprotein, yet they become markedly cachectic and die evidently from some severe nutritional derangement. From these observations it is quite evident that the tetany itself, while the most striking manifestation of parathyroid deficiency, is, in all probability, merely the result of a hyperexcitability of the central nervous system.

We can, then, distinguish these two distinct series of phenomena: (1) A serious metabolic disturbance resulting from the absence of parathyroid secretion; and (2) the tetany which appears later and is probably a result of this primary disorder of the catalytic processes. The increase in the excretion of total nitrogen and ammonia, with increase in some of the salts in the urine, and the increased ammonia content of the blood after parathyroidectomy are rather suggestive of some form of acid intoxication. If we then assume that the "circulating toxin" is a normal metabolic product of an acid nature, and is combined with bases before excretion, we can explain the increase in the bases found in the urine. It is possible that para-

thyroid secretion normally oxidizes this intermediate acid body. In the absence of the secretion there is an increased nitrogenous metabolism. It does not seem necessary to assume that all cases of tetany are due to parathyroid insufficiency, or the functional disturbance of the gland that is assumed when anatomical evidence is wanting, as there may possibly be disturbances of catalysis with similar changes from other causes than parathyroid insufficiency. This is illustrated by some observations in a recent case of gastric tetany (Kinnicutt¹⁸), in which the tetany was allayed by calcium given by mouth, but at autopsy the parathyroid glands were found to be normal.

THE ELECTROCARDIOGRAM IN CLINICAL MEDICINE.

I. THE STRING GALVANOMETER AND THE ELECTROCARDIOGRAM IN HEALTH.

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THE ability to record the changes in potential of the heart muscle which accompany its activity gives us an entirely new point of view of the normal and morbid action of the heart, and promises to throw new light upon the many problems presented by the physiology and the pathology of the organ. It is little wonder, therefore, that a considerable interest has rapidly developed in electrocardiography, and that even in the short time that has elapsed since it was first demonstrated a fairly voluminous literature of the subject should have accumulated. It is the purpose of the present paper to describe as briefly as possible, and with as few technicalities as may be consistent with clearness and accuracy, the principles of electrocardiography and its practice and the results that we have obtained with it in the course of the last winter.

An electrocardiogram is a graphic record of the action current of the heart muscle, and is obtained by leading this very feeble current to an exceedingly sensitive galvanometer, the excursions of the moving part of which are permanently recorded by throwing its shadow upon a moving strip of photographic film. For many years it has been a fact well known to physiologists that every muscle contraction has associated with it certain definite and interesting

changes of electrical potential. Thus, the piece of muscle becomes essentially a feeble galvanic cell in which the active portion corresponds to the zinc plate, the passive to the copper, and when the two are connected the current which passes is called the action current of the muscle. The fundamental fact which must always be borne in mind in the study of the electrocardiogram is that the surface of that portion of a muscle which is active is negative to all the rest of the surface, which is positive.

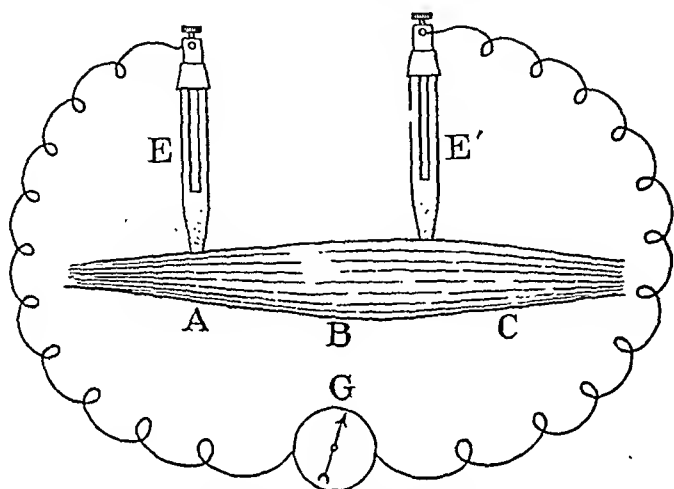


FIG. 1.—Scheme to illustrate the action current of a simple muscular contraction.

If we take a piece of muscle, *A, B, C* (Fig. 1), apply electrodes *E, E'*, connect these by wires to a galvanometer *G*, and then stimulate the muscle at *A*, a wave of contraction begins at this point, and this electrode becomes negative to *E'*, which is positive, and the needle *G* shows a corresponding variation. When the wave of contraction reaches the middle point *B*, the potential of *A* and *B* now being the same, no current passes and the needle returns to the zero point. The wave now passes toward *C*, which in turn becomes negative to *A*, and the needle is deflected in the opposite direction.

Fig. 2 represents diagrammatically the curve obtained by passing the action current of a simple muscle contraction through the string-galvanometer. At *A* the contraction wave passes the first electrode, at *B* it is midway between them, and at *C* it has passed beyond the second electrode. This record is a graphic representation of what is called a diaphasic variation, and this type of curve will be referred to later in connection with certain phenomena met with in cases of disease.

In 1856 Kölliker and Müller¹ succeeded in detecting the action

¹ Nachweis der negativen Schwankung des Muskelstromes am natürlich sich contrahirenden Muskel, Verhandl. d. phys.-med. Gesell. im Würzburg, 1856, vi, 528 to 583,

current of the frog's heart by applying electrodes to its surface, and so proved that this current is obtainable. In 1887 A. D. Waller,² using the capillary electrometer and applying his electrodes to various portions of the surface of the human body, succeeded in recording the curve of the action current of the human heart and demonstrated some of its characteristics. He studied and compared

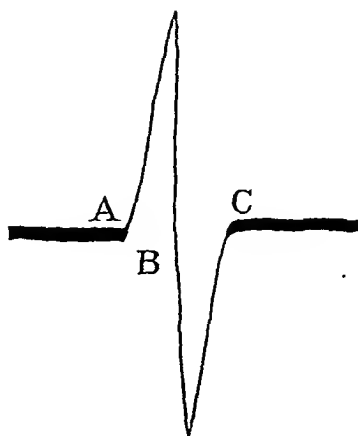


FIG. 2.—Scheme of a diphasic variation accompanying a simple muscle contraction.

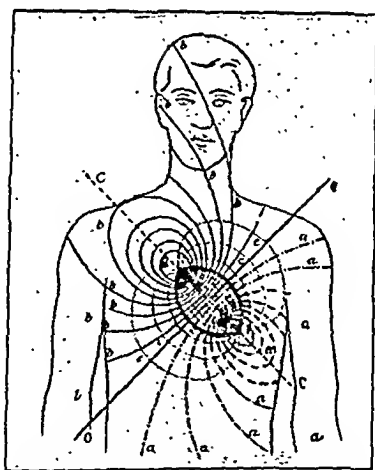


FIG. 3.—Lines of diffusion of the action current of the heart (after Waller).

the curves obtained by leading the currents from various parts of the surface of the body, and so attempted to establish the lines of diffusion of the heart's action current, and published a diagram embodying his conclusions, of which Fig. 3 is a reproduction. He concluded that the most useful leads were those from the right

² A demonstration on Man of Electromotive Changes accompanying the Heart's Beat, Jour. Physiol., 1887, viii, 229 to 234.

arm and left leg. Waller's diagram, while it gives a general idea of the current diffusion, yet in its details has been proved by later researches and by using more satisfactory apparatus than was at that time at his disposal, to be far from an accurate and full representation of the facts.

Up to the present no complete and satisfactory study of the lines of diffusion made with the aid of modern instruments has appeared. Owing to the feebleness of the currents and to the unsatisfactory nature of the instruments in use, it was not supposed that the action current would ever be used as a practical aid by the clinician, and physicians took but scant interest in it. Indeed, the existence of muscle action currents, though taught and demonstrated in the early years of the medical curriculum, has, as a rule, been forgotten by practitioners. Waller³ himself has recently said that when he made his first observations he did not imagine that they would ever be of practical value to the physician.

The capillary electrometer used by Waller and the other early investigators had numerous disadvantages. While very sensitive and completely aperiodic, it was too slow in its response to give a faithful record of changes of potential as rapid as those taking place in the heart, and its difficulty of manipulation and its liability to become disordered made it, on the whole, an unsatisfactory instrument, except in the hands of a trained physicist and one willing to devote a great deal of time to it. Moreover, by reason of its slowness of response, the curves obtained by it had to be subjected to a mathematical reduction before they could be interpreted.⁴

For all of these reasons Professor Einthoven,⁵ of Leyden, was led to undertake the construction of a more satisfactory instrument. Taking the well-known Deprez-d'Arsonval galvanometer as a starting point, and considering the mathematical formula which expresses its factor of merit, he was led to reduce the weight of the moving part to a minimum and increase the strength of the magnetic field, and so ultimately elaborated what is today known as the Einthoven string galvanometer (Ger., Saitengalvanometer). The principle upon which it operates is as follows:

Whenever a current of electricity passes through a magnetic field

³ The Electrocardiogram of Man and of the Dog, as shown by Einthoven's String Galvanometer, *Lancet*, 1909, clxxvi, 1448.

⁴ G. H. Burch, On a Method of Determining the Value of Rapid Variations of a Difference of Potential by Means of the Capillary Electrometer, *Proc. Roy. Soc.*, 1890, xlviii, 89; On the Time Relations of the Excursions of the Capillary Electrometer, *Phil. Trans. Roy. Soc., Lond.*, 1892, elxxxiii, 81; W. Einthoven, Ueber die form des menschlichen Electrocardiogramms, *Pflüger's Archiv*, 1895, lx, 102; J. Burdon Sanderson, The Electrical Response to Stimulation of Muscle, *Jour. Physiol.*, 1899, xxiii, 325; Hermann and Gildemeister, Untersuchungen ber die Eigenschaften und die Theorie des Kapillar-Elektrometers, *Pflüger's Archiv*, 1900, lxxxi, 491; S. Garten, Ueber ein einfaches Verfahren zu Ausmessung der Capillarelektrometer-Curven., *Pflüger's Archiv*, 1902, lxxxix, 613.

⁵ Ein neues Galvanometer, *Annalen der Physik*, 1903, xii, 4 Folge, 1059 to 1071; Die Konstruktion des Saitengalvanometers, *Pflüger's Archiv*, 1909, exxx, 287 to 321.

at right angles to the lines of force, it tends to be deflected to one side or the other, according to its direction. If we stretch a conductor between the poles of a magnet at right angles to the lines of force, it will tend to be deflected when traversed by a current, the direction of the deflection depending upon the direction of the current. Einthoven constructed a powerful electromagnet, through the field of which he stretched a very delicate fiber, which was either a fine platinum wire or a quartz thread which had been silvered to render it a conductor. The diameter of the finest strings measures as low as 2.5μ or about $\frac{1}{3}$ the diameter of a red blood corpuscle, and they are invisible to the naked eye except in a strong light. The mass is so small that it is unweighable. A micrometer screw enables the operator to increase or diminish the tension of the string at will, and so vary the sensitiveness of the instrument. An arc light operating in connection with a system of condensing lenses, and an objective and projection ocular project the shadow of the string upon a screen, the varying of the distance of which enables one to secure any magnification that may be desired. A standard cell of constant electromotive force in connection with a system of plug rheostats enables the operator to send any desired current through the string, and so, by varying the tension of the string its sensitiveness may be made to conform to any desired standard.

Following the standard established by Einthoven and now in general use, it is customary so to adjust the instrument that the shadow moves one centimeter when a difference of potential of one millivolt is applied to the terminals of the string. It cannot be too strongly urged upon those making electrocardiograms to adopt and follow the standard suggested by Einthoven, as this enables curves made in various laboratories to be compared readily. The quickness of response is such that no mathematical revision of the curve is necessary, and within fairly wide limits the excursion of the string is directly proportionate to the voltage, so that the curve can be used not only to study the direction of the current, but to study its voltage quantitatively. If electrodes are applied to any part of the body it is found that differences of potential regularly exist which give rise to currents. These are probably the sum of the minute currents resulting from the glandular activities of the body, especially of the skin, and they develop a current of very considerable strength. This current, which varies in individuals and in the same person at different times, is called the skin current (Dubois-Raymond⁶).

In taking an electrocardiogram the skin current produces a deflection of the string, and must be exactly compensated by throwing into the circuit, in the opposite direction, an equivalent amount of

⁶ Untersuchungen über thierische Elektrizität, Berlin, 1849.

current from a cell. It is desirable that the patient be as nearly as possible in a state of absolute relaxation, and he must be cautioned not to move or to allow any of his muscles to be in a state of tension. A sudden violent action of muscles may produce such a change of potential as to break the string. We have found it best to have the patient lying on his back on a bed, with the head and shoulders slightly raised.

It is not necessary that the subject should be near the instrument. We have the wards of the Presbyterian Hospital connected with the laboratory by a system of wiring which permits the taking of any patient's electrocardiogram without removing him from his bed. Einthoven⁷ connected the hospital with his physiological laboratory, about 1.5 kilometers distant; and secured records in this way, calling them telecardiograms. It is necessary to adjust the wiring so that there shall be no induction from neighboring telephone and other electric circuits. Most of our records are telecardiograms. The chief advantages of this method are the saving of time and labor for the operator, the additional convenience and comfort of the patient, and the additional chance of obtaining records free from evidence of voluntary muscle tension.

Different types of electrodes are used by various observers, but they consist almost always of a vessel containing a solution of sodium chloride into which the limb is put, though sometimes non-polarizable electrodes are used. We have obtained our best results with electrodes devised by us, which consist of a large, thin, flexible sheet of German silver covered with thin felt. These are dipped in hot salt solution and bound about the extremities by tapes. These electrodes give an almost constant difference of potential of about half a millivolt, so that they may for clinical purposes be regarded as normal electrodes. The resistance of the electrodes themselves is exceedingly small, being about 2.8 ohms for the pair, and we have uniformly found the resistance of the patient's body, together with these electrodes, not greater than when the tanks furnished by Edelmann are used. Fig. 4 shows these electrodes in use. It is customary to estimate and record the body resistance just before the record is made, and this is generally from 200 to 500 ohms. The resistance is determined by a Wheatstone bridge and telephone.

The movements of the shadow of the string in response to the action currents of the heart are recorded permanently by any satisfactory photographic registering apparatus, to which a timing device is attached which also casts its shadow upon the moving film. Our records were all made with Edelmann's⁸ large galvanometer with the complete accessory appliances as supplied by him, including a registering apparatus driven by an electric motor, the time being

⁷ Le télécardiogramme, *Archiv. Internat. de Physiol.*, 1906, iv, 143.

⁸ Mittheilung No. 5, *Physik-mech. Institut, Munich*, 1909.

recorded either by a Jacquet timer giving fifths of a second, or by a Zimmermann spring timer beating tenths.

The apparatus is erected in a special laboratory in the Presbyterian Hospital, and is shown complete in Fig. 5, which, however, does not show the mounting of the galvanometer subsequently

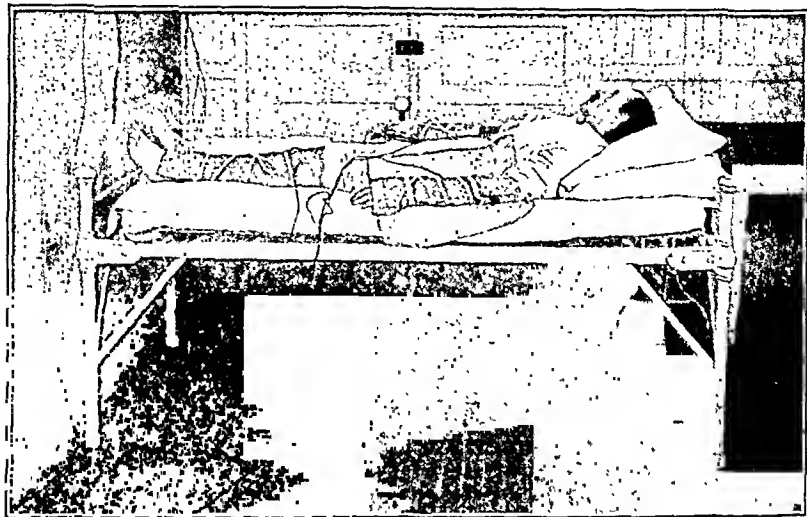


FIG. 4.—The electrodes in use.

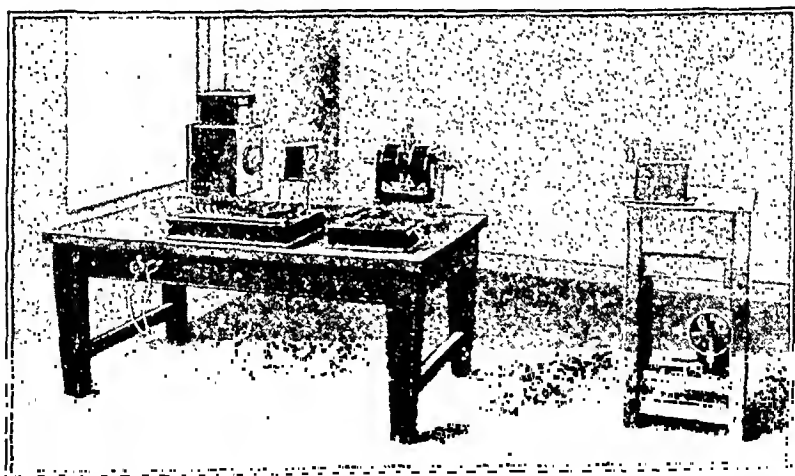


FIG. 5.—Complete apparatus for obtaining electrocardiograms.

adopted to eliminate vibration. The proximity of the hospital to electric car lines has made the problem of eliminating vibration a difficult one. While the string galvanometer is far less sensitive to vibration than most types of galvanometers, a complete absence of vibration would be very desirable. At the time the curves presented

in this paper were recorded, we had not succeeded in entirely eliminating such vibrations, but they can in every case be fairly readily distinguished from waves produced by variations of electrical potential.

The character of the curve is found to vary with the parts of the body from which it is led off. It is found advisable to take at least three different leads in each case, and, following Einthoven, these are termed I, II, III, and are as follows:

- I. Right arm and left arm.
- II. Right arm and left leg.
- III. Left arm and left leg.

The records obtained from these three leads show certain characteristic differences, which will be described a little later.

In order to bring out certain features of special cases, any two points on the body whatever may be used as leads, but it is desirable, in order that the results of different observers may be compared, that at least the three standard leads should be used in every case. The steps necessary to be taken, then, in making an electrocardiogram are as follows:

1. The attachment of three electrodes to the patient.
2. The establishment of the sensitiveness of the galvanometer at the standard point and the making of a control curve.
3. The estimation of the resistance in each of the three leads.
4. The compensation of the skin current.
5. The recording of the string movements caused by the heart's action current which now become apparent.
6. The developing and printing of the film, which it must be remembered is not a negative, but a positive.

In spite of the apparent complexity of the procedures above described, we have found that the time required to make a complete set of three records, one from each lead, exclusive of the time taken in attaching the electrodes to the patient and in developing and printing the film, was generally from three to five minutes. There are certain possible sources of error which should be borne in mind by the operator, the chief among which we have found to be the following:

1. Mechanical vibration due to instability of foundation. The conditions will naturally differ in each equipment, and the difficulties must be met and overcome according to the indications. Our galvanometer stands upon the floor of a fireproof hospital pavilion on the second floor, and through the building receives a certain periodic vibration. This we have largely obviated by standing the instrument on sand contained in a large box.

2. Induction from outside sources.
3. Defective insulation.
4. Induction caused by hissing of the arc lamp as explained by Rothberger and Winterberg.⁹

5. Tenseness of the patient's muscles, which gives rise to a fine vibration of the string (Einthoven¹⁰) at the rate of 50 per second (Piper¹¹).

6. Gross muscular movements, such as coughing or sneezing, which cause large irregular movements of the string, which can be readily distinguished from those due to the heart's action.

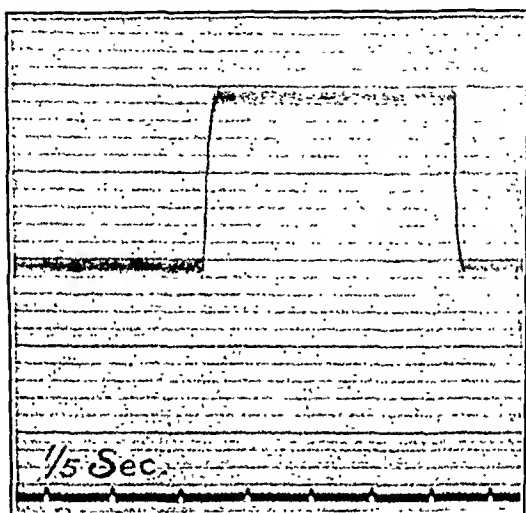


FIG. 6.—Control curve.

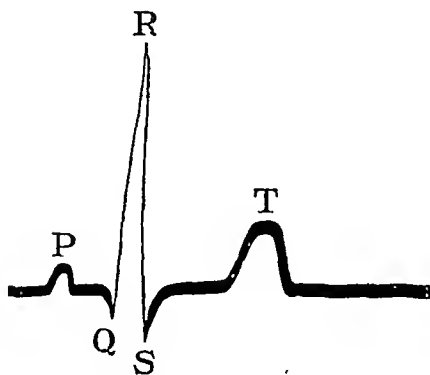


FIG. 7.—Scheme of the normal electrocardiogram.

To insure the proper working of the galvanometer and to guard against the presence of misleading induction effects or mechanical vibrations, it is advisable to precede the taking of every record by the recording of a control curve.

¹⁰ Die galvanometrische Registrierung des menschlichen Elektrokardiogramms, zugleich eine Beurtheilung der Anwendung des Capillar-Elektrometers in der Physiologie, Pflüger's Archiv, 1903, xcix, 480; Weiteres über das Elektrokardiogramm, Pflüger's Archiv, 1908, cxxii, 526.

¹¹ Ueber den willkürlichen Muskeltetanus, Pflüger's Archiv, 1907, cxix, 301 to 337.; Zeits. f. Biol., 1908, I, 393.

Fig. 6 is such a curve, obtained by applying to the string terminals a difference of potential of 2 millivolts. This may conveniently be done at the time the sensitiveness of the instrument is adjusted, and gives a permanent record of the sensitiveness for that particular record. Such control curves have been taken for the greater number of our records.

The satisfactory interpretation of all the elements of the normal electrocardiogram is not yet possible, but its principal features can be explained, and correspond to definite events in the cardiac cycle. Fig. 7 represents diagrammatically a "normal" electrocardiogram in which the various waves have been lettered according to the system originally suggested by Einthoven. Fig. 8 is an electrocardiogram taken from a healthy individual while sleeping, and shows the curve obtained with each of the three leads. It is in the highest degree desirable that this nomenclature should not be departed from without the best of reasons, as failure of uniformity causes an enormous increase in the difficulty of comparing records, a difficulty which is already considerable. Certain observers have already adopted a different lettering upon grounds that seem inadequate, and have thus added greatly to the labor of reading and understanding their communications.

The normal record is seen to present a base line which shows the position of the string when no current passes, that is, when the potential of its two ends is the same, and starting from the base line are five waves lettered P, Q, R, S, and T. The best understood and most important of these are those which rise above the base line, that is, which are positive, P, R, and T. The term positive here has reference only to the direction of the curve with reference to the base line. Each of these positive waves means that the base of the heart is electrically negative to the apex, or, to be more exact, that the algebraic sum of all the differences of potential that exist in the heart at that instant results in negativity of the upper end of the string toward the lower end to an extent indicated by the amplitude of the wave. On referring to Waller's diagram, Fig. 3, it is readily understood why it is that not only the height of a wave but also its direction may be modified by varying the position of the electrodes upon the body. P corresponds to the contraction of the auricle. The causal relation between auricular systole and P has been positively established by study of the exposed heart in animals, as well as by the observation of cases of auriculoventricular dissociation in human beings. Q, R, S, and T all correspond to the systole of the two ventricles. R and T are the most constant of these, and as far as our present understanding goes, are the most important and useful in electrocardiography. R and T are always present in health, while Q and S may, either one or both, be absent.

Observers are not in entire agreement as to the significance of the

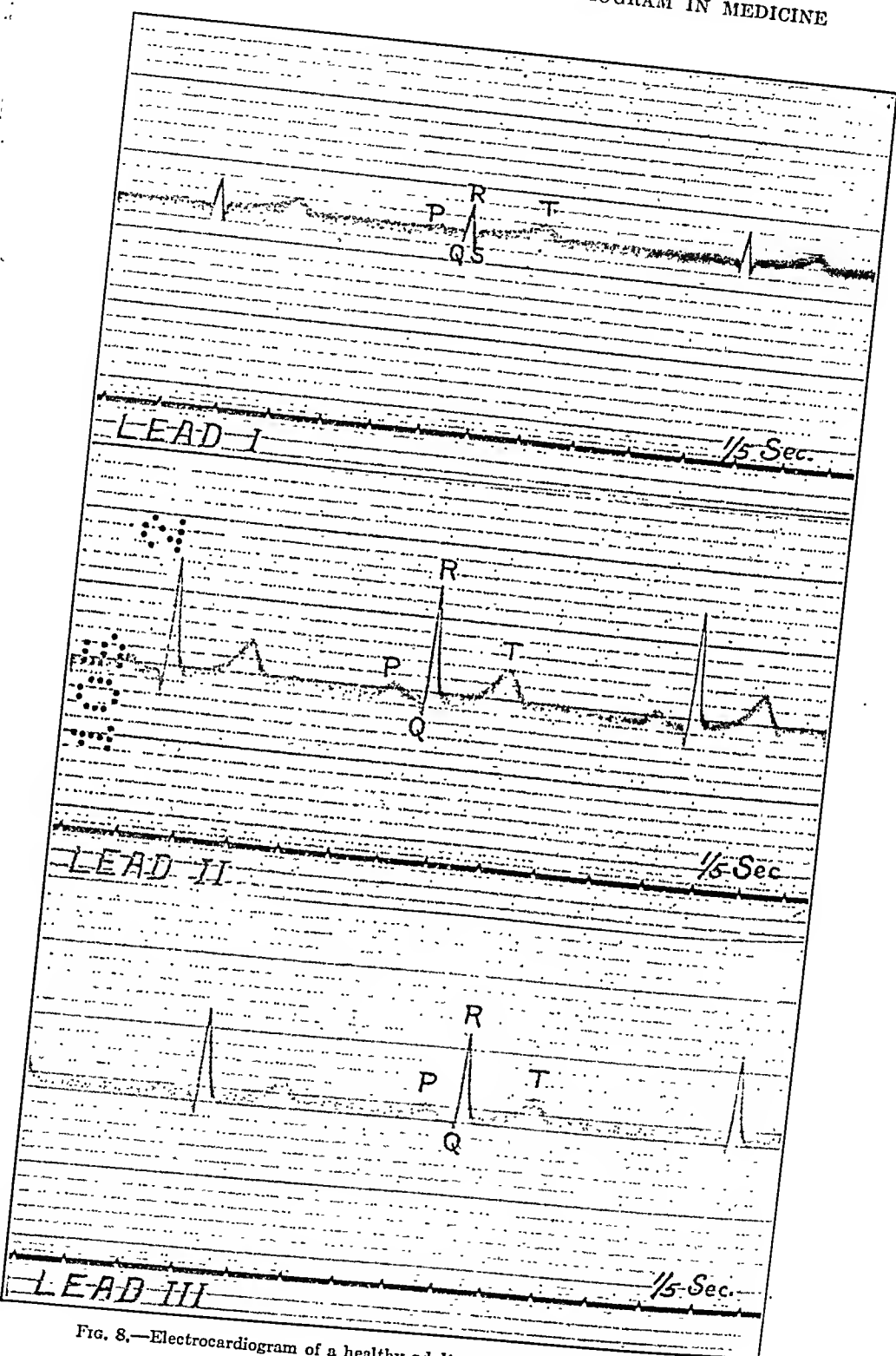


FIG. 8.—Electrocardiogram of a healthy adult male, taken while sleeping.

waves that make up the ventricular portion of the curve, but the following is a summary of the leading views:

The space between P and Q indicates the time elapsing between excitation of the auricles and ventricles, and is, therefore, the best measure we have of the auriculoventricular interval.

Q directed downward, and therefore indicating negativity of the apex toward the base, has been supposed by Einthoven¹² to be due to an initial contraction of apical fibers, and the variations in this wave in individual cases to be due to variations in the distribution of the fibers of the bundle of His. Q in health is always small and is often absent. It passes at once into R, the highest, most uniform and useful of all the waves.

R corresponds to the initial contraction of the ventricles at the base, and indicates marked negativity of the base of the heart. It is possible that it is produced by the initial contraction of the papillary muscle system. As has been shown by Hering,¹³ the papillary muscle system contracts before the apical muscle mass, a physiological fact which seems to bear out the latter view and is in agreement with the anatomical findings of Tawara,¹⁴ that the earliest and most extensive distribution of the fibers of the bundle of His is to the papillary muscles.

We may be reasonably sure that the wave R continues to rise while the contraction wave of the ventricle is spreading from base to apex, and the summit of R marks the instant at which this contraction has reached the apex of the heart; the time during which this wave R is rising is then a measure of the time occupied by the ventricular systole in spreading from base to apex, and may well be a matter of value in the study of diseases of the heart muscle, for, knowing the distance, it is possible to calculate the rate of travel, as has been done by Gotch¹⁵ in the exposed heart of the tortoise. During the interval between R and T the string remains at zero. This does not indicate a cessation of muscular activity, but only that all parts of the muscle are equally active and therefore the potential of base and apex remain the same. It is probable that this time period also will be of value in the study of the diseased heart.

R is frequently followed immediately by a negative wave S, the significance of which is still in doubt.

T, the final wave of the ventricular phase of the electrocardiogram, is usually directed upward, and therefore indicates relative negativity of the base to the apex, that is, a preponderance of basal over apical activity at this instant, which is the very end of a ventricular systole;

¹² Pflüger's Archiv, 1908, exxii, 577.

¹³ Ueber die Beginn des Papillarmuskelaaction und seine Beziehung zum Atrioventrikulärbündel, Pflüger's Archiv, 1909, exxxvi, 225.

¹⁴ Das Reizleitungssystem des Säugetierherzens, Jena, 1906.

¹⁵ The Succession of Events in the Contracting Ventricle, as shown by Electrometer Records (Tortoise and Rabbit), Heart, 1910, i, 3.

this might mean either that the base remained in contraction after the apex had begun to relax, or that a second contraction occurred at the base at this time. If the latter is the case, T might be produced either by fibers that had already been in activity during R, or by fibers that had not previously been brought into play. On account of the law of the refractory phase, the former hypothesis seems unlikely, and recent studies by Gotch¹⁶ show fairly conclusively that the latter supposition is the true explanation.

Gotch, with his delicate capillary electrometer, has investigated the electrical condition of various portions of the heart's surface in animals throughout the cardiac cycle. This work has thrown so much light upon what had been one of the most puzzling features of the normal electrocardiogram that it seems wise to describe his conclusions in some detail. Using flexible electrodes of special construction, Gotch found that when the current was led off from the base of the ventricles at a point as far distant as possible from the spring of the aorta, the other electrode being applied to the apex, the electrocardiogram presented the form of a diphasic variation. When, however, the basal electrode was applied at the root of the aorta, the other being still at the apex, a curve was obtained with a final upward-directed wave similar to the T wave of the normal electrocardiogram, indicating that at this terminal instant the region at the root of the aorta was negative to the apex, that it was in a state of greater activity than the apex. Gotch then proved that this activity in the region of the aorta was due to the contraction of fibres which did not take part in the original basal contraction. This he accomplished by applying electrodes to the base of the ventricles at a distance from each other, one close by the root of the aorta. This arrangement of electrodes gave a curve which was a simple diphasic variation, indicating that the first mentioned point became first active, then inactive, the second point vice versa.

To quote from Gotch's conclusions: "The interpretation of the triphasic records is shown to be in accordance with the view that each contraction begins in the general mass of base ventricular substance, that it then develops at the apex, and that it finally develops in the ventricular mass near the aorta (or pulmonary artery), with a possible extension into the wall of the aorta or pulmonary artery." His reasonable inference from these facts is that the wave of excitation in the heart follows the route of the original primitive cardiac tube of the lower animals and the embryo, the bending of which upon itself in the course of development gives rise to the complicated heart of the adult mammal. Thus, this mode of propagation is the remains of an original peristalsis, and probably in the finished heart is necessary to the completest possible emptying of the organ in the shortest possible time and with the least possible

labor, and T expresses the homologue of the final contraction of the bulbus arteriosus in the lower animals.

It is customary to designate the lead by which any wave has been obtained by attaching the corresponding Roman numeral to the wave letter, for instance, P III, meaning P in lead III. As a rule, in health all the waves are best marked in lead II, especially R. In many persons all the excursions in lead III are very small, and T III may be negative in some normal subjects. Negative P and R waves in any lead are an indication of abnormality. It is an interesting fact, and one which necessarily follows from the mode of leading off the current from the surface of the body, that the height of any wave in lead III can be obtained by subtracting the value of the same wave in lead I from that in lead II, or, as Einthoven¹⁷ puts it, lead II minus lead I equals lead III.

The electrocardiograms of a number of healthy individuals show differences, but the curve in each case will be peculiar to that person and will be constant, so that persons may be identified by their electrocardiograms, as was noted by Einthoven. These variations, however, are within the normal range of health.

Many normal electrocardiograms show physiological variations. For instance, the height of R varies with respiration, being lower during deep inspiration. T is increased by any agency which increases the force of ventricular systole, as exertion or increased blood pressure. Increased pulse frequency causes a shortening of the diastolic interval with an approximation of T to the following P, which may reach a point where P and T occur together.

There are certain features of the normal heart beat which can be studied better by this method than by any other. For instance, it is possible to study the time of propagation of the wave of excitation through either the auricle or the ventricle. Moreover, the interval between the auricular and the ventricular phase of the electrocardiogram gives a very accurate index of the time of propagation of an impulse through the bundle of His. Inasmuch as the form of the electrocardiogram depends upon the point of origin and direction of propagation of the wave of excitation, any variation in such origin and direction will be indicated by corresponding changes in the form of the curve. Thus, it becomes evident that this method is of great value not only in the investigation of morbid conditions, but also in the study of normal physiology.

In the second part of this paper the study of the electrocardiogram in diseased conditions of the heart will be taken up.

¹⁷ Weiteres über das Elektrokardiogramm, Pflüger's Archiv, 1908, cxxii, 558.

THE EFFECTS OF INJECTIONS OF KILLED STREPTOCOCCI.

BY GEORGE H. WEAVER, M.D.,

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THE effects of injections into the living body of killed virulent streptococci have been studied from two points of view: (1) as to their ability to produce immunity against similar virulent living cocci which may be subsequently introduced; (2) as to their power of bringing about in the infected body a condition of resistance which will overcome an infection already existing. Since the process doubtless is similar in each case, we may first refer to the immunization produced in the uninfected, and afterward discuss the effects of therapeutic injections in man.

It is generally accepted that the destruction of streptococci within the body is accomplished through phagocytosis. Of the antibodies which appear during immunization against streptococci the streptococco-opsonin in the blood serum has been found most important because it brings about phagocytosis of the streptococci. By estimation of the amount of such opsonin, attempts have been made to measure the degree of immunity. To be exact such estimates should be made with the virulent infecting organisms or the one used for producing the immunity. While other antibodies beside the opsonin may play a part in combatting the streptococci and their products, we have no ready method by which these may be determined. A factor which until recently has been largely left out of account in the estimation of opsonin as a measure of the ability of the body to cope with streptococcic infection is the leukocyte of the individual. Especially in infections of long standing, the relation between the bacteria, and the serum and leukocytes of the individual must be taken into consideration in estimating the ability of the individual to overcome the infecting bacteria. Rosenow¹ was the first to direct attention to this fact as regards pneumococci, and Boughton² has recently shown that the same is true in the case of streptococci.

IMMUNIZING POWER OF KILLED STREPTOCOCCI IN THE UNINFECTED ANIMAL. In the artificial immunization of animals against streptococci for the purpose of obtaining antistreptococcic serum, it has been found desirable by some to produce a certain degree of resistance to streptococci by injecting killed cultures before resorting to injections of living bacteria. This method has succeeded in large animals as well as in rabbits. The primary injections of killed

¹ The Role of Phagocytosis in the Pneumococcidal Action of Pneumonic Blood, *Jour. Infect. Dis.*, 1906, iii, 683; Immunological and Experimental Studies on *Pneumococcus* and *Staphylococcus Endocarditis*, *Jour. Infect. Dis.*, 1909, vi, 245.

² Interaction of Serum, Leukocytes, and Bacteria in Phagocytosis as Observed in a Case of Recurrent and Relapsing Erysipelas, *Jour. Infect. Dis.*, 1910, vii, 111.

streptococci enables the animal to withstand small doses of living virulent cultures which otherwise would provoke fatal infections.

Dr. Tunncliffe and I³ have reported some studies in streptococcic immunization in rabbits in which we showed that streptococci which had been killed by suspension in a strong solution of galactose were able to stimulate the production of antibodies in a much greater degree than the same culture when killed by heat. When cultures of streptococci are heated sufficiently to kill all the individuals, the antigenic properties of the bacteria are largely interfered with. We made observations on rabbits, some receiving galactose-killed and some heat-killed streptococci in equal numbers. Following the injections the opsonin for the streptococcus was estimated. In those rabbits which had received the galactose-killed streptococci the rise in the opsonin was quite marked, while in those which had received the heat-killed bacteria the opsonin was but little affected. If, after an interval of a few days, the rabbits were injected with virulent living streptococci in doses sufficient certainly to kill control rabbits, it was found that the animals which had received galactose-killed streptococci had acquired a considerable degree of resistance, often amounting to a complete immunity to the dose employed, while those which had received corresponding doses of heat-killed streptococci showed no increased resistance, but often died sooner than the controls.

We know of but two connections in which injections in man of killed streptococci for prophylactic immunization have been employed on any considerable scale. Acting on the assumption that scarlet fever is due to infection by streptococci, Gabritschewsky and other Russian physicians have extensively injected killed streptococci as a prophylactic against scarlet fever. While they claim very favorable results, the observations have not been sufficiently controlled by observers elsewhere to allow of any final judgement regarding them.

Boughton and I⁴ undertook by injections of galactose-killed streptococci as early as possible in cases of scarlet fever, to bring about a sufficient degree of immunity to prevent the later streptococcic complications associated with this disease. Eighty-eight cases were injected during the acute stage. We were unable to observe any appreciable benefit from the procedure. In this case two unfavorable factors existed—the fact that heterologous cultures had to be used, and that the body was probably reduced by the disease already present in its ability to respond to the antigen.

THERAPEUTIC INJECTIONS OF KILLED STREPTOCOCCI. The great majority of the therapeutic injections of killed streptococci with which I am personally familiar have been employed in cases

³ A Study of Streptococcus Immunization, Jour. Infect. Dis., 1908, v, 589.

⁴ The Injection of Heterologous Streptococci, Killed by Galactose, in Erysipelas and in Scarlet Fever, Jour. Infect. Dis., 1908, v, 608.

of erysipelas and in contagious diseases, especially scarlet fever. In most of the reported instances in which killed streptococci have been injected for therapeutic purposes, the bacteria have been killed by heat. In 1907 Tunncliffe and I⁵ treated streptococcic infections in a case of diphtheria and in six cases of scarlet fever with heat-killed streptococci, but with no apparent benefit.

When it was found that the galactose-killed streptococci possessed in rabbits greater antigenic powers than heat-killed ones we undertook a study of the effects of the former in man. It was found that galactose-killed streptococci, when injected in a normal child, caused a pronounced rise in the opsonin for the streptococcus injected. This work was carried out by Dr. Boughton and myself.⁶ Twenty-two cases of erysipelas were treated with injections of polyvalent, heterologous streptococci killed by suspension in 25 per cent. galactose solution, the dose being about 200,000,000 streptococci. Of these cases, 2 were relapsing, 6 migrating, and 3 recurrent. In only 3 of the series, each of the migrating form, did there appear to be any beneficial effect. In these the extension stopped within two days and recovery was rapid. In the acute stage of erysipelas there was no appreciable benefit from the injections. This was to be expected since the powers of the body were already taxed in producing the immunity which leads to recovery in the usual course of the disease. In one case of chronic nasal streptococcic infection with recurring attacks of acute facial erysipelas, a prompt and permanent cure followed the use of galactose-killed homologous streptococci. With improvement the streptococco-opsonic index rose considerable above normal and remained so for several weeks.

Thirty-one cases of scarlet fever with streptococcic complications, such as purulent rhinitis, otitis media, mastoiditis, and cervical adenitis, were given injections of galactose-killed streptococci. Of these, 11 (36 per cent.) showed prompt improvement. The beneficial effects were more marked in subacute and chronic cases. It is not unlikely that better results would have followed the use of homologous cultures in some of these cases. In a few cases the injection of killed bacteria appeared to cause an aggravation of the local infection.

As a continuation of this work, Boughton⁷ undertook to treat by injections of galactose-killed homologous streptococci, cases of contagious diseases with streptococcic complications which had become chronic. In his series of 14 rather refractory cases there were ascribable to the treatment of 36 per cent. of recoveries, 28 per

⁵ Effects of Injections of Homologous Streptococci, Killed by Heat, in Streptococcus Complications in Contagious Diseases, Jour. Infect. Dis., 1908, v, 585.

⁶ The Injections of Heterologous Streptococci, Killed by Galactose, in Erysipelas and in Scarlet Fever, Jour. Infect. Dis., 1908, v, 608.

⁷ Injections of Homologous Streptococci, Killed by Galactose, in the Treatment of Suppurative Complications of Contagious Diseases, Jour. Infect. Dis., 1910, vii, 99.

cent. of improvements, while 36 per cent. were apparently uninfluenced. In 7 cases with marked evidence of sepsis he noted prompt improvement (in one to three days) in 6, the other having been moribund when injected. In a case of recurrent and relapsing erysipelas which he treated there was no beneficial effect from the injections.

DIFFICULTIES ENCOUNTERED IN JUDGING THE RESULTS OF THE INJECTIONS. In reading the reports of isolated cases treated by injections of the so-called "streptococcus vaccines" one is impressed by the great difficulty of arriving at any reasonable appreciation of the value to be attached to the injections as a factor in the course of the disease. The tendency of erysipelas to run a rapid course terminating in recovery in the great majority of cases is well known. Even in patients who are desperately sick, with no special treatment, a sudden change for the better and uninterrupted progress to recovery is so often observed that one hesitates to ascribe such phenomena to therapeutic measures. In the preparation of an homologous galactose-killed streptococcus, six to eight days are required before one is assured of a sterile material for injection. It has been noticed, in routine work, that by this time about two-thirds of the cases of scarlet fever with streptococcic complications have so far improved as to require no injections. If "vaccines" had been administered in each of these cases when the preparation of vaccine was begun, they would have been placed as recoveries to the credit of the injections. On the other hand, the sudden and progressive improvement which often follows the injection of killed streptococci in cases of long-standing streptococcic infection which have shown no tendency toward recovery, cannot fail to impress the observer as due to some factor introduced by the injection, and as not at all likely to have occurred in the natural course of the disease.

The failure of favorable results from the injection of killed streptococci in some cases of chronic infection may depend on several factors. The ability of the body cells to react and produce antibodies may have been exhausted by the prolonged course of the disease. Again, the infecting bacteria may have become so acclimated to their surroundings that they are no longer affected by the antibodies present. The interaction of serum, cells, and bacteria may be so distorted that the bacteria continue to thrive even in the presence of abundant antibodies.

CONCLUSIONS. 1. Destruction of streptococci within the body is accomplished through phagocytosis, for which opsonin is essential.

2. In estimating the ability of the individual to cope with streptococcic infections, the leukocytes as well as the serum must be taken into account.

3. Killed streptococci when injected into an animal may raise its resistance to living virulent streptococci.

4. It is desirable that injections of killed streptococci as a prophylactic against scarlet fever be tried under conditions favorable for control.

5. Heating interferes with the antigenic properties of streptococci. These properties are preserved when streptococci are killed by a strong galactose solution.

6. Injections of galactose-killed streptococci early in the course of scarlet fever do not prevent later streptococcic complications.

7. Injections of galactose-killed streptococci in cases of acute erysipelas and in the acute stage of streptococcic complications of contagious diseases appear not to influence the course of the disease.

8. In subacute and chronic erysipelas and in streptococcic complications of contagious diseases which have become chronic injections of galactose-killed streptococci are sometimes followed by favorable results, and at other times no appreciable effect is seen.

9. Great caution must be observed in ascribing improvement in these cases to the injections.

REVIEWS.

SURGERY: ITS PRINCIPALS AND PRACTICE. By Various Authors. Edited by WILLIAM WILLIAMS KEEN, M.D., LL.D., Emeritus Professor of the Principles of Surgery and of Clinical Surgery, Jefferson Medical College, Philadelphia; and JOHN CHALMERS DA COSTA, M.D., LL.D., Professor of the Principles of Surgery and of Clinical Surgery, Jefferson Medical College, Philadelphia. Vol. V, pp. 1274, 550 illustrations. Philadelphia and London: W. B. Saunders Company, 1909.

A LITTLE more than three years ago the first volume of the *System of Surgery* edited by Professors Keen and DaCosta was reviewed in these pages; the completion of the work so promptly is a credit to both publishers and editors. As in the publication of all similar works, the editors have found it impossible always to present the various articles in orderly succession, owing to delay on the part of several authors. Thus, in the last volume are included certain articles which should have appeared earlier in the series, their places having been taken by articles finished, perhaps, ahead of time. If a revised edition shall be called for, as appears not unlikely from the popularity of the volumes, the misplaced articles may then be restored to their proper position.

By all means the most important contribution in the present volume, if not in the entire series, is that on the surgery of the vascular system, by Professor Rudolph Matas. This article forms a complete monograph of 337 pages, and is a model of all that is learned, systematic, and exact. Discussing first the surgery of the heart and pericardium, the author next passes to that of the arteries, which includes the treatment of senile gangrene, wounds, and subcutaneous rupture; he insists on the permanent value of the Golden Rules for ligation for the control of hemorrhage, and reiterates what some surgeons seem willfully to forget, that there are absolutely no exceptions to the rule that a bleeding artery must be ligated in the *wound*, and not elsewhere; though he urges that in suitable cases lateral or end-to-end suture be attempted, especially in the thigh. The surgery of the veins includes phlebitis, but not thrombosis and embolism, which were discussed in Volume I. He draws no sharp distinction between phlebitis and phlegmasia alba dolens, which some authorities are inclined to consider a form of

angioloecitis, not of phlebitis; he considers it a toxic non-pyogenic phlebitis, but accounts for the œdema of phlebitis by coincident invasion of the lymphatics, or extension of the clot from the main venous trunks to the collaterals. He asserts that nothing can be said in favor of the constitutional treatment of phlebitis by intravenous injections of antiseptics. The concluding section of this extensive article is devoted to aneurysm: Gangrene remains the greatest objection to the treatment by ligation, as the operative mortality is now very small; and as gangrene, post-operative trophic changes, and neuralgias, are due to the persistence of the sac filled with clot, any improvement in operative methods implies an obliteration or removal of the sac. There is no question in any one's mind that the methods of intra-saccular suture devised and systematized by Matas himself are the best of all the radical operations. The proper treatment for aneurysms of the individual arteries is then considered at length, the statistical results of the different operations being given at length. One is as much impressed with the amazing industry as with the judiciousness and impartiality of the author.

The surgery of the female genito-urinary organs is discussed by Drs. E. E. Montgomery, J. M. Fisher, and P. B. Bland, in a not very noteworthy article of 256 pages. Bland, who discusses methods of examination, diagnosis, etc., recommends the use of chloroform anesthesia for every pelvic examination, "if there are no contraindications." Montgomery's contribution, which embraces the surgery of the uterus, broad ligaments, tubes, and ovaries, is disfigured by slovenly writing and numerous lapses from good grammar. His verbal descriptions of operations may be termed as clear as mud, and he is parsimonious with his illustrations. He prefers Cesarean section to all its substitutes; at page 522 he says cardiac lesions complicate fibroids very infrequently, and at page 526 asserts they "are so common as to lead to the supposition that the presence of fibroids is an exciting cause for degenerative processes in that organ;" and at page 550 he recommends when the "ventrum" is weak, that the "abdomen should be supported by strips of iodoform gauze passed the greater way around the trunk."

Gibbon contributes an article on surgical technique which presumably was intended for one of the earlier volumes. It covers the usual ground in the usual manner, being simple, practical, and complete. As the author warms to his subject he drops his professorial "we," employed in the first half of the article, for the singular pronoun, with a relief which seems as great to the writer as it is to the reader. Gibbon's "conveniently arranged operating suite" has no light in the etherizing room, unless the use of a skylight be intended; and a stretcher could not be taken in or out of the recovery and waiting rooms for patients until most of the beds had been removed.

Bickham contributes two articles—on ligations, and on ampu-

tations. Apart from a few blunders in the illustrations, repeated from his "Operative Surgery," there is occasion for little but praise. Fig. 285 has the leaders wrongly placed, naming the flexor longus hallucis the soleus, and calling "popliteus" a muscle which looks strangely like the flexor longus digitorum; Figs. 872 and 873, showing the use of Wyeth's pins at the hip joint, show one pin penetrating the ilium, while the other transfixes the penis. Though Bier's osteoplastic amputations are described, Bunge's much simpler method is not even mentioned, nor can any reference be found to the methods of Vanghetti, Ceci, and others, for the application of cinematic prostheses.

Warbasse contributes an admirable article on the surgery of the bones and joints. His discussion of the infections of bone probably is unexcelled for clinical acumen and simplicity of statement; it may be studied by all with profit. Speaking of malignant tumors, he thinks the *kind* of tumor need be given little consideration; the object of the operation should be to remove *all* of the growth, no matter what its variety; amputation does no more, and is not invariably necessary for this purpose. When a malignant tumor of bone invades the soft parts, exarticulation is the only way to remove it entirely.

A short and modest contribution on plastic surgery is from the pen of John B. Roberts. He discusses the modern advances and prospects in restorative and reconstructive surgery, transplantation of organs, tissues, etc.; and concludes with a detailed account of certain rhinoplastic and other operations.

The surgery of accidents is discussed by W. L. Estes; C. H. Mayo devotes 14 pages of text, and 1½ of bibliography to explaining how little really is known of the surgery of the parathyroids; and Frazier discusses the intracranial surgery of the fifth and eighth nerves. In Vol. II Woolsey devoted 12 pages to the palliative and peripheral operations on the fifth nerve, and here 21 pages are devoted to its intracranial surgery. Surely it is disheartening as well as ludicrous to reflect that in this case, as in that of the parathyroids, surgeons know so much of an empirical nature about treatment, without knowing the pathology of the lesions in question. Frazier shows that the operative mortality in the surgery of the Gasserian ganglion is now less than 4 per cent. in competent hands, and that so far recurrences have taken place in only about 7 per cent. of cases—though there have been no recurrences after division or avulsion of the sensory root. For mere division of the eighth nerve Frazier finds unilateral removal of the occiput sufficient, but the bilateral operation is required for the removal of tumors.

The volume concludes with articles on general anesthesia, by H. A. Hare; on local anesthesia, by Lennander; on spinal anesthesia by Zachrisson; on the surgery of the infectious diseases, by G. E. Armstrong; on the use of the x-rays and radium in surgery, by

E. A. Codman; on the legal relations of the surgeon, by Hampton L. Carson, of the Philadelphia Bar; on the laboratory as an aid to surgery, by W. M. L. Coplin; and on the surgical organization of a hospital, by A. J. Ochsner. Space forbids mention of the many points of interest in these later sections. Special attention is called to the articles by Carson and by Ochsner, which will well repay the short time required for their perusal.

In bringing to a happy conclusion their labors in behalf of the science of surgery, the editors are to be sincerely congratulated. Yet the congratulations which reach them come, in the immense majority of instances, from those who have no conception whatever of the laboriousness of the work, and of the "*tædium vitæ*" which the task of editorship of such a system entails. The editors know, better than can any reviewer, how far short of their ideal the concrete realization of their efforts appears at the last; yet they probably also know, or if they do not now, will begin to appreciate in succeeding years, the fact that this system is, nevertheless, at the present time unexcelled in the world; that the various contributions maintain a common standard of excellence which, so far as the present reviewer is aware, has only once been equalled in a work of like nature; that the handiness of the volumes, and their excellent illustrations will make them appeal to a wider class of readers than was ever reached before; that the diffusion of knowledge thus secured will ameliorate the sufferings and save the lives of countless hordes of humanity; and with all this the editors cannot fail to realize the truth of that saying of Dio Chrysostom: *οὐ γὰρ τὰ ὀνόματα πίστεις τῶν παραγμάτων ἐστί, τὰ δὲ πράγματα καὶ τῶν ὀνομάτων.*

A. P. C. A.

THE DISEASES OF INFANCY AND CHILDHOOD. By HENRY KOPLIK, M.D., Attending Physician to the Mount Sinai Hospital, New York. Third edition; pp. 944; 204 engravings and 39 plates in color and monochrome. New York and Philadelphia: Lea & Febiger, 1910.

It has been a pleasant task to examine this new and revised edition of Dr. Koplik's well-known text-book, and to compare it page by page with the original text that first appeared eight years ago, for it reveals the evidences of thorough and judicious revision on every page. The original plan of the work showed, as every first edition must in some degree, the marks of haste in preparation and the rough edges of new construction, in which clearness of diction and style was often too obviously sacrificed to an effort at conciseness and terseness of expression. In this respect the new edition has been wonderfully improved by very extensive rewriting and repolishing.

The text now flows smoothly in an easy and attractive style; it reads well. The original plan of arrangement has been improved and certain incongruities of classification have been remedied.

The entire book has been reset in clearer and more attractive type, and the typographical arrangement of headings has been improved so that the page now presents a handsomer and more legible appearance than the earlier edition. These changes alone have added fully 30 pages to the make-up, thus leaving more than 200 extra pages for new material and amplifications of the original text.

Chief among these we notice new matter in the technique of treatment and diagnosis of the infectious diseases. The section on nutrition and infant feeding, which is, after all, the touchstone of merit of any new treatise of this class, has been extensively revised, amplified and added to, and now presents a well-balanced and complete review of the subject of modern feeding, with a clearly outlined explanation of the mathematical basis of percentage modification—a subject which the original edition left largely to the ingenuity of the student. The whey modifications, which have proved so valuable a help in the practice of many pediatricists are apparently appreciated, but are rather discountenanced because of the asserted great difficulty of their home preparation—a statement which is contrary to the experience of those who have become skilled in this method.

The chapters on diseases of the stomach, and those of the nervous system, such as cerebral palsies, encephalitis, poliomyelitis, tetany, and amaurotic idiocy, have been recast, while those on cystitis and pyelitis have also been brought up to date, and chapters on idiocy and dwarfism have been added. Special mention should be made of an excellent resume of the causes of sudden death in newborn infants, and a satisfactory amplification of the earlier chapter on the management of the congenitally weak infant. Taking it altogether, the new Koplik text-book is a worthy monument to the fame of its author, and is entitled to a place beside the modern classic textbooks of Rotch and Holt.

T. S. W.

TUBERCULOSIS: A TREATISE BY AMERICAN AUTHORS ON THE ETIOLOGY, PATHOLOGY, FREQUENCY, SEMEIOLOGY, DIAGNOSIS, PROGNOSIS, PREVENTION, AND TREATMENT. Edited by ARNOLD C. KLEBS, M.D., Lausanne, Switzerland (formerly of Chicago); Pp. 968; 246 illustrations. New York and London: D. Appleton & Co., 1909.

THE dearth of books upon tuberculosis in America until within the last three years is a matter of considerable interest, for up to this time, since the publication of the works of Morten (1838), of Gerhard

(1842) and of Flint (1879), no extensive contribution had been made to this subject. Much has been published abroad on tuberculosis by men unfamiliar with the work done in America, and one of the objects of the book about to be reviewed is said to be to set forth clearly in one volume the work done not only abroad, but particularly in America, and it has been done.

The majority of the articles are excellent, as the names of such authors as Baldwin, Klebs, Minor, Osler, Pirquet, Ravenel, and Sewall would indicate. Of the four introductions, those by Biggs (prophylaxis) and Trudeau (treatment) are very brief, but Osler has written entertainingly and instructively of the history of tuberculosis, and Pirquet has contributed a very suggestive article on tuberculosis in childhood, in which he discusses the portal of entry, allergy, anergy, scrofulosis, etc.

Ravenel, who treats of etiology, and Hektoen, who writes on the pathology, have covered their fields thoroughly; and Baldwin has discussed the different problems of resistance, predisposition, immunity, and individual prophylaxis in a most readable and, it is unnecessary to state, admirable manner. Ravenel still recommends Gabbett's solution, and it is with some satisfaction we note that Minor discards it, for it may lead to error in diagnosis even in pulmonary affections. No mention is made of Eulenberg's antiformin and the facility with which cultures can be obtained by the use of this solvent. Ravenel believes that not only is infection through the alimentary tract possible from food and dust, but that it unquestionably occurs in a large proportion of cases. Hektoen fails to mention some of the recent work on the presence of tubercle bacilli in calcareous foci, and believes with Birch-Hirschfeld that pulmonary infection is more often aërogenous than hematogenous. He states that "more frequently, the larger hemorrhages result from erosion by caseation or suppuration," instead of rupture of a minute aneurysm, which many (Rasmussen, Percy Kidd, etc.) hold is almost invariably the case.

The frequency of tuberculosis is dealt with by the editor. He inclines to the view that tuberculosis is eminently a children's disease, something like measles, and disbelieves that even a rigidly enforced system of registration can ever furnish a basis for accurate estimation of the damage done by the disease. He has little faith in mortality and no faith in morbidity statistics as ascertained at present. It is no easy task to discuss scientifically tuberculosis among the dark-skinned races of America, and the article by Coleman is not entirely satisfactory for one who wishes facts upon this subject. Hutching, in his article on tuberculosis in insane asylums, fails to mention, in discussing the frequency, the excellent work of Madison at Danvers with tuberculin, as well as one or two foreign articles of importance, but on the whole his article is good.

One of the best sections in the book is that contributed by Minor on symptomatology, physical examination, and diagnosis. He

writes well and entertainingly from a large experience, from which we regret he has not drawn more definite facts and data. He believes that many symptoms are due to secondary infection and rests his belief in this view largely upon clinical experience, in which we cannot agree with him. He also fails to note that when, even after long continued treatment in bed without effect, fever disappears when the patient gets up, the result may be due to auto-inoculation; also that in some cases sweats are due to action of the toxin on the vasomotor regulating centres. It is of interest to find that his patients in Asheville in the matter of weight gaining do not follow the course that Brown found to be the case in patients in the Adirondacks (an upward tendency from August to Christmas, maintenance or slight variation of the weight until Easter, then a steady fall to August). Every practitioner, whether or not interested in tuberculosis, should read carefully the section on physical examination, which includes history taking. With his technique in making sputum preparations we are not in accord entirely, for we believe that instead of thin smears, which he recommends, we should make the smear as thick as can be done to insure even staining and complete discoloration, for is it not our object to examine *as much* sputum as possible? It is interesting to note that Minor believes that healthy men will react to tuberculin if the dose be sufficiently large, while in another section Pirquet states that for an uninfected organism tuberculin is an "indifferent substance which it tolerates in every form and quantity." Later, "sudden death" is stated to be the usual result of the intravenous injection of the antigen into a rabbit with transferred (passive) anaphylaxis, but Yamanouchi states distinctly that the majority have only respiratory distress. These are really only microscopic defects in an article which is not surpassed by any that we know of in English.

The subject of individual prophylaxis is well and sanely discussed by Baldwin, who wisely lays great stress upon the necessity of protecting the infant from every possible source of infection, and includes in his article well-devised plans for outdoor play porches for children.

Knopf, in ninety-eight pages, sets forth every phase of all the public measures useful in the prophylaxis of tuberculosis. Upon this subject he is a well-known authority, and his article will accordingly bear weight.

Brown has written a detailed article upon tuberculin. His conclusions are so moderate that they doubtless will please neither the upholders of specific treatment nor satisfy its opponents. His article in another edition would be more interesting if it included an occasional temperature chart—to illustrate some of his statements. Figures 148, 149, and 150, showing the results obtained in patients treated with tuberculin, are meaningless, as there are no charts showing the results in the untreated.

The specific treatment of mixed and concomitant infections by Webb is a very interesting article that leaves the impression upon

one's mind that "homologous vaccines," prepared from sputum with little washing, are of great benefit in some instances, but that with the technique employed the treatment rests not on a scientific, but on an empirical basis.

It is ever wisest in our opinion to have men write on those subjects that interest them most. We are consequently surprised to see that Coleman writes from a health resort upon "home treatment" by sanatorium methods. The cities of Philadelphia and Boston contain many who advocate and practise home treatment. Another disappointment is that some "sanatorium" man did not write upon sanatorium treatment, which would include hygienic-dietetic treatment (food, exercise, and fresh air). A man who has lived in a sanatorium looks upon these things somewhat differently from the rest of us. Coleman states, and rightly we believe, that tannic and gallic acids are of no avail in hemoptysis, but Knopf, who contributes a section in the appendix on the symptomatic treatment of tuberculosis, advises it. It is interesting to note that we could find no mention of euphoria and of the inestimable value of morphine when properly administered in the terminal stages. The construction and management of the sanatorium is written of by Klebs, who pleads for cheaper structures, and urges the age of some of the wooden chalets in Switzerland as proof of the permanency of wooden structures. There is a vast difference between the dry, sunny climate of the Alps and the moist climate of eastern North America. No one, of course, believes in luxury for poor patients, but too much has been written about their discontent on returning home from a sanatorium, using this as an argument to make these unfortunates as uncomfortable as possible. Much depends, we believe, in training the family at home in what they should do for the invalid. Klebs justly praises King's lean-to as a great advance in sanatorium construction. His article is admirably illustrated.

Climate is discussed generally and theoretically in an excellent article by a good physiologist and physician; Sewall; while Barlow treats climatic therapeutics very fully and, we believe, absolutely impartially. Anyone who still holds that climate may be of some avail will find here a detailed and reliable article. Freeman and McArthur have contributed a section on surgical tuberculosis, in which they discuss briefly tuberculous adenitis, osteitis, arthritis, myositis, meningitis (tuberculomas), enteritis, peritonitis, tuberculosis of the genito-urinary tract, and tuberculous ischio-rectal abscess and fistula. The appendix includes a description of the method of estimating the opsonic index, by Lincoln; an educational leaflet for teachers, by Goodall; facts a mother should know concerning tuberculosis, by Kress; a model for a law leading to the suppression of tuberculosis; instructions for the physician's use in private practice; a formulary for treatment, and devices for prevention of tuberculosis, by Knopf; and diet lists with common measures of ordinary foods expressed in

amounts of protein, fat, and carbohydrates, and calories. The bibliography is excellently arranged and the index is admirable, referring not only to the text, but to the bibliography as well. Dr. Klebs, the editor, deserves much credit for the vast amount of work he has put upon this volume, which we believe will be the standard work on the subject in America. Of course, many printer's errors and grammatical mistakes have been overlooked, but this is to be expected in a first edition. The book is the most satisfactory exposition of the subject which has yet been published in America. L. B.

PROGRESSIVE MEDICINE. A QUARTERLY DIGEST OF ADVANCES, DISCOVERIES, AND IMPROVEMENTS IN THE MEDICAL AND SURGICAL SCIENCES. Edited by HOBART AMORY HARE, M.D., Professor of Therapeutics and Materia Medica in the Jefferson Medical College; Assisted by LEIGHTON F. APPLEMAN, M.D., Instructor in Therapeutics in the Jefferson Medical College, Philadelphia. Vol. II, 1910; pp. 363; 35 illustrations. Philadelphia and New York: Lea & Febiger, 1910.

VOLUME II of *Progressive Medicine* for 1910 begins with a discussion of recent advances in hernia, by William B. Coley, who devotes fifty-six pages to the subject. Special attention is directed to traumatic hernia, inguinal hernia in the female (illustrated by several excellent cuts), the pathology and treatment of umbilical hernia in the adult, epigastric hernia, primary tuberculosis of the hernial sac, ischiadic hernia, the operative treatment of inguinal hernia in children, the operative treatment of undescended testicle, retroperitoneal hernia, and certain rare types of hernia. Edward Milton Foote devotes seventy-four pages to the surgery of the abdomen, exclusive of hernia, discussing especially sensation in the abdominal cavity, the hemophiliac as a surgical subject, the treatment of peritonitis, apparatus for proteolysis, subphrenic abscess, the disappearance of peritoneal adhesions, the cosmetic effect of a laparotomy, gastric dilatation and acute intestinal obstruction, the results of gastro-enterostomy, gastric and duodenal ulceration, the pathological relationship of gastric ulcer to gastric carcinoma, laparotomy on the battlefield, the mortality after appendectomy, megacolon, carcinoma and diverticulitis of the sigmoid, the "rectal shelf" a sign of carcinoma elsewhere, anesthetics for rectal surgery, operations for hemorrhoids, carcinoma of the rectum, the surgery of the biliary passages, pancreatic necrosis, etc. John G. Clark devotes eighty-four pages to gynecology, particular mention being made of carcinoma of the uterus in its many aspects; the treatment of retrodisplacement of the uterus, dysmenorrhœa and ster-

ility; the time to operate in pelvic inflammatory cases; extrauterine pregnancy; primary carcinoma of the Fallopian tube; the end-results of ovariectomy for ovarian tumors; the value and limitations of conservative surgery of the ovary; vaginal hysterectomy; submucous perineorrhaphy; the symptoms of visceral adhesions of various types; early rising after operation; intestinal obstruction; acute postoperative dilatation of the stomach; backache from static not pelvic disorders; normal variations in structure of the endometrium, etc. Alfred Stengel devotes ninety-six pages to diseases of the blood, diathetic and metabolic diseases, diseases of the thyroid gland, of nutrition, and of the lymphatic system. Special attention is devoted to pernicious anemia, leukemia, leukanemia, Addison's disease, obesity, myxedema, exophthalmic goiter, infantile scurvy, hemorrhagic purpura, Henoch's purpura, diabetes, acidosis, gout, etc. Edward Jackson devotes twenty-seven pages to ophthalmology, discussing the international standard of visual acuity, protective spectacles, anesthetics, ophthalmia neonatorum, suppurating ulcer of the cornea, keratitis, anisocoria, iritis, uveal tuberculosis, glaucoma, cataract, retinal hemorrhage, retrobulbar optic neuritis, decompression for choked disk, lacrymal obstruction, refraction and accommodation, nystagmus, etc. The series, of which this is one volume, is virtually indispensable to him who would keep abreast of medical progress. A. K.

THE SERUM DIAGNOSIS OF SYPHILIS AND THE BUTYRIC ACID TEST FOR SYPHILIS. By HIDEYO NOGUCHI, M.D., M.Sc., Associate Member of the Rockefeller Institute for Medical Research, New York. Pp. 173; 14 illustrations. Philadelphia and London: J. B. Lippincott Company, 1910.

DR. NOGUCHI has prepared a very valuable and most opportune little volume, designed, as he states, to give a brief yet adequate account of the principles of serum hemolysis and of the behaviors of the combinations of antigen and antibodies toward hemolysis, so essential for a proper understanding of the subject. In addition, he discusses at some length the quantitative relationship of the factors playing a part in these phenomena, an aspect of the subject which he believes has not received the consideration it deserves; he also gives in detail the technique of the Wasserman reaction, as well as that of the method which he himself recommends; and he adds a chapter on the butyric-acid test for syphilis. The volume deals with a subject now attracting widespread attention, and is possessed of special merit not only on account of its contents, but also because it has been prepared by one who in many respects is a pioneer in the

special field of which it treats. It is clearly and lucidly written, and should serve to elucidate many of the obscure points connected with the Wassermann reaction and its applications. The volume is further enhanced by a glossary and an extensive bibliography.

A. K.

LE MASSAGE PLASTIQUE DANS LES DERMATOSES DELA FACE. By DR. RAOUL LEROY. Paris, 1909. Pp. 208.

THIS little work is brought to the attention of the medical profession not only by the author, but also through Dr. Lucien Jacquet, physician to the Hospital Saint-Antoine, who writes the preface. Dr. Jacquet is a well-known physician, accomplished in general medicine as well as in dermatology, so that his endorsement of the subject matter and methods of treatment recommended lends additional interest to the volume. Most if not all of the cases were treated in the wards or clinic of the Hospital Saint-Antoine. Some photographs of cases, previous to and after treatment, bear witness to excellent results. There is much that is worthy of study in the method of massage recommended, and the book may be read with profit by physicians.

L. A. D.

A TEXT-BOOK OF PHYSIOLOGY. By WILLIAM H. HOWELL, Ph.D., M.D., LL.D., Professor of Physiology in the Johns Hopkins University, Baltimore. Third edition; pp. 998; 296 illustrations. Philadelphia and London: W. B. Saunders Company, 1910.

AFTER a lapse of two years a new edition of Professor Howell's *Physiology* is called for. During this period many new facts, as well as new points of view, have been added to our store of knowledge. The author does not claim that he has "winnowed all of the extensive field," although he has made many corrections and additions throughout the book. Of these, one may, perhaps, mention the results of the study of divers physiological, especially muscular, phenomena, by the use of Einthoven's string galvanometer. This instrument has served to elucidate many of the problems of muscular contraction, and at the present time is coming into use in modern clinics in the study and investigation of disorders of the heart; the electrocardiograms thus obtained being of much value. There is also an excellent discussion of blood pressure, and of the means and methods of its study. As in the second edition, there is a full presentation of the results of the widespread application of chemical research; one finds, in consequence, a full and comprehensive discussion of ions, especially as they relate to the heart beat—

which, as is well known, as has been much illuminated by the studies of Professor Howell himself. The chapter on internal secretions is comprehensive and satisfying, and contains an account of those winged chemical messengers, or hormones, now believed to be of major importance in the correlation of the metabolic activities of the body. To the chapter on the physiology of reproduction the author has added a discussion of growth and senescence, based upon the observations and suggestive speculations of Rubner on energy requirements and growth mechanism. There are many other additions throughout the book, all of which serve to maintain it as it has been, in the forefront of publications on physiology. A. K.

DIATHESIS AND OCULAR DISEASES. BY A. MAITLAND RAMSAY, M.D., Ophthalmic Surgeon to the Glasgow Royal Infirmary. New York: William Wood & Co., 1909.

IN these lectures the author makes a plea for a return, to a certain extent, to older views, current before the days of bacteriology, modified, of course, by the results of modern research. The keynote may be summed up in his statement: "Too much attention is being paid to the germ, and far too little to the soil on which it falls."

Three main diatheses are considered: The neurotic, the scrofulous, and the arthritic. Under the former are classed the protean complaints, when there is little amiss with the refraction or muscle balance. Scrofula, which the author denies to be synonymous with tuberculosis, is held responsible for the phlycten. Under the arthritic, with two subdivisions, the gouty and rheumatic, and of which the ocular manifestations may be the only external sign, are described inflammations of the conjunctiva and sclera, uveal tract, retina and optic nerve, toxic amblyopia, and glaucoma—a pretty respectable number of pathological processes, surely. Influenced by such views, it goes without saying that general treatment, medicinal, diathetic, regimen, etc., is accorded a large place. The special means recommended against the ocular maladies themselves do not differ much from those commonly employed. The chapter on glaucoma, which makes up one-third of the entire book, is also the best. The author thinks it doubtful whether medical resources ever prevent the downward trend of the disease. He believes that clinical experience teaches that in every form of genuine glaucoma iridectomy is the safest procedure, and the earlier the operation is performed the more satisfactory the result. He thoroughly agrees with Priestley Smith's recommendation, that the sclerotic should be punctured behind the lens preliminary to iridectomy. Of the newer operative methods, some are simply mentioned, and others omitted entirely, as not having come within the experience of the author. T. B. S.

PROGRESS OF MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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The Leukocyte Picture in Variola.—KAMMERER (*Deut. Arch. f. klin. Med.*, 1910, xcix, 354) has studied the blood of four cases and finds that a moderate leukocytosis (10,000 to 30,000) occurs at least as soon as the vesicular stage, and subsides very gradually with frequent slight fluctuations lasting well into convalescence. This leukocytosis is due to an absolute increase in the lymphocytes, which occurs as early as the fifth day, and which can still be made out three months after the infection. Polymorphonuclear leukocytes are relatively decreased in number (averaging 42.2 per cent.). Their absolute number is on the average normal, though occasionally slightly increased. In severe cases a moderate number of myelocytes and of normoblasts occurs in the first few days. Large mononuclears, transitionals, eosinophiles, and mast-cells are present in normal numbers.

The Chemistry of the Heart Muscle in Cardiac Insufficiency.—C. VON RZENTKOWSKI (*Ztschr. f. klin. Med.*, 1910, lxx, 337) has made a distinct advance in the study of the cardiac muscle, by examining chemically portions of the right and left ventricles in a series of non-cardiac and of cardiac cases. The percentage of N (from which the protein was calculated), of sodium chloride, and of water were determined. In normal hearts there is a constant difference between the right and left ventricle. The right heart muscle contains about 95 per cent. as much protein, 92 per cent. as much total solids, and nearly 150 per cent. as much NaCl as the left. The variation is not large. In a series of cases with dilatation of the right ventricle and relatively slight disease of the left, the right ventricle showed marked, the left slight, decrease in dry weight and protein, with definite rise in NaCl content. The NaCl content of these dilated right ventricles was 171 per cent. of that of the normal right

ventricle, while the normal difference between the right and left ventricular content (12 : 8) was here increased (13 : 8). In hypertrophy of the left ventricle, secondary to vascular changes, the muscle is slightly richer in protein, the dry weight is substantially unchanged, but the NaCl content is distinctly raised, though not as high as in the muscle of dilated hearts. The rise in NaCl content of the heart muscle is out of all proportion to that in the general tissues. It is not a mere oedema but an intracellular retention which goes parallel with weakening of the muscle fibre and of which it is a closer index than are morphological appearances. It may perhaps be an intoxication. At all events, the rise of NaCl content in hypertrophic cardiac muscle is very interesting, agreeing as it does with the tendency of hypertrophied muscle to dilatation and with the beneficial results of the NaCl-poor diets in cases of cardiac insufficiency.

Ptosis of the Cecum.—LARDENNOIS (*Presse médicale*, 1910, 419) calls attention to a case reported by Barnes, of Liverpool, of a boy, aged fifteen years, with all the signs of a very severe appendicitis. At operation an enormously dilated cecum was found which resembled a huge cyst. The appendix was normal. Ceeostomy was performed and the boy recovered. This case was considered a dilatation of the cecum occurring without apparent cause. In contrast to this, there are cases of chronic dilatation of the cecum and subsequent ptosis where the musculature has atrophied and the cecum has doubled on itself or is in the pelvis, or some other malposition. In these cases, after an indiscretion of diet, or other cause, crises of pain and feeling of distention occur in the right iliac fossa. These crises appear often, and are very acute. The pain is poorly localized; the situation is generally about McBurney's point. On examination of this region the wall of the cecum is usually palpable. Pressure exacerbates the pain by exaggerating the distention of the cecum or promoting contracture. If this pressure is from below upward, the pain is eased. The right lateral decubitus is usually painful; the left, or the ventral, favor emptying of the cecum and the patient instinctively takes these lateral positions. Palpation of the cecum gives the sensation of a soft fluctuating tumor like a vessel full of water. This tumor usually comes into contact with the abdominal wall almost down to Poupart's ligament. Lardennois' case, post mortem, showed a cecum 13 cm. long with a capacity of more than 700 c.c., compared with a normal average length of 6 cm. and capacity of 200 or 300 c.c. In 80 subjects examined, he found four other similar cases. Of 100 subjects examined by Alglave, in 17 the cecum was within the pelvis, and in 6, within the cul-de-sac of Douglas. Robinsion has reported 10 instances with the cecum in the pelvis and with a capacity of 600 c.c. or more. Lardennois believes the condition is more frequent than is recognized, that it occurs more frequently in women than in men, and more in Germany, and, in a general way, in those races which are great eaters. The stasis is progressive, and in time the general condition is very much affected. The patients suffer from malaise, are easily fatigued, restless, are troubled by any clothing about the abdomen; in fact, become actually invalids. They are nervous and hypochondriacal. Ptosis of the cecum which, as a rule, is only an inconvenience, may thus become a serious affection and deserve attention. These painful

attacks have been ascribed to such affections* as appendicitis, movable kidney, ovarian cyst, malposition of the uterus, adhesions, neuralgia, and neuroses. The pathognomonic sign of ptosis of the cecum is formulated by Lardennois as follows: When forcing the contents of the transverse and ascending colon toward the cecum, pain is produced in the right pelvic region. On the other hand, pressing the contents of the cecum toward the colon, without violence, causes disappearance of the pain. Aids to diagnosis are artificial dilatation of the large intestine and x-rays after bismuth ingestion. Medical therapeutics consists in a limited diet, disinfection of the intestines by lactic acid ferments and the use of laxatives; massage and gymnastics of the abdominal muscles are advised. Surgical intervention is indicated in two instances—first, if the condition is found during an appendix operation, when fixation of the cecum in the iliac fossa is advisable; second, when there is no appendicitis and the ptosis resists medical treatment and is severe enough to cause general disability. Then iliac fixation, or a plastic operation, or partial resection may be performed.

The Cammidge Pancreatic Reaction in 1475 Cases.—Since his last publication, in 1906, CAMMIDGE (*Proc. Royal Society of Medicine*, 1910, iii, 163) has examined 1500 samples of urine derived from 1475 cases, with special reference to this reaction. The method used is the same as described previously. Of 17 cases of acute and subacute pancreatitis, 13 gave a positive pancreatic reaction. Six of these at operation showed an acute inflammation. In 3 the pancreatitis had been the sequel to an attack of mumps. In 859 cases of chronic pancreatitis the reaction was obtained 364 times; 40 times in 60 cases of stone in the common duct; 18 times in 7 cases of stone in the gall-bladder; 4 times in 10 cases of growth in the common duct; 103 times in 194 cases of intestinal catarrh; 42 times in 53 cases of catarrhal jaundice; 27 times in 50 cases of duodenal ulcer; 5 times in 47 cases of gastric ulcer; 8 times in 13 cases of sprue; 4 times in 6 cases of pernicious anemia; 2 times in 11 cases of tuberculosis; 6 times in 8 cases of typhoid fever; and 14 times in 21 cases of cirrhosis of the liver and pancreas. All of these conditions Cammidge considered as causes of chronic pancreatitis. In 4 cases of pancreatic calculi the reaction was obtained 3 times; twice in 4 cases of pancreatic cyst and once in a case of pancreatic infantilism. In 73 cases of cancer of the pancreas 24 positive reactions were obtained. In a miscellaneous group, 461 of the 467 cases gave a negative pancreatic reaction. In the last group are specimens of urine from 50 presumably healthy individuals, none of which gave a positive pancreatic reaction. Cammidge believes that his experience in these five years confirms the claim that he made—that the reaction is clinically useful in its improved form. He does not think that it is pathognomonic or that taken alone it will enable one to form a correct opinion in every instance. But he does think that when the results of the examination of the urine are considered in conjunction with the clinical symptoms and an analysis of the feces, a trustworthy diagnosis is capable of being arrived at in nearly every case of pancreatic disease. As to the nature of the reaction, it is probably due to the destruction of some substance with a glyconucleo-protein content which yields a pentose on hydrolysis, and since the

percentage of pentose in the dry weight of the pancreas is nearly five times as great as in any other organ of the body, and is more easily combined and more readily set free than the corresponding sugar in other tissues, the reaction is obtained with much greater frequency and more constantly in lesions involving active degenerative changes in that organ than in others. A strongly positive reaction cannot be accepted as a conclusive indication of pancreatic infection. Cirrhosis of the pancreas will not give rise to a reaction unless there is also some active inflammation going on at the same time. So, too, in cancer of the pancreas, there is usually no reaction, for no destruction of gland substance takes place unless secondary inflammation sets in.

Schlesinger's Sign in Tetany.—The "leg phenomenon" in tetany (AMER. JOUR. MED. SCI., 1910, 758) has been confirmed by Glassner in one adult; and by Gottlieb in one of two children. ALEXANDER (*Deut. med. Woch.*, 1910, No. 22, 1030) reports positive findings in two adults, negative in two infants. He believes that it is entirely due to mechanical stimulation of the sciatic nerve by stretching; and is entirely analogous to the Trousseau phenomenon, which Fränkl-Hochwart by animal experimentation has shown to be of nervous, not vascular, origin. In both adults, pressure at the sciatic point elicited the typical position of the foot (talipes varus or equinovarus) as well as did Schlesinger's procedure—flexion of the thigh with extended knee. The pulse in the foot remained unchanged. Compression of the femoral artery did not lead to the typical foot position. In one case he was also able to bring on the typical position of the hand by hyperextension of the arm, causing traction on the brachial plexus. The radial pulse remained unaffected.

Primary Syphilitic Inoculations in Animals.—Numerous observers have succeeded in inoculating rabbits with syphilis; particularly by injection into the testicle or by implantation of tissue under the tunica vaginalis. The results have, however, been inconstant and the incubation time at least four to six weeks. TOMASZEWSKI (*Deut. med. Woch.*, 1910, xxxvi, 1025) has obtained quite constant results "within 10–14–18 days, only seldom later." His technique consists in forcing the testicle out of the vaginal canal by abdominal pressure, making a small incision in the scrotum and then by blunt dissection, in which trauma is desirable rather than to be avoided, making a long pocket into which tissue from a primary lesion is inserted. The local reaction is not marked, but a small round-cell infiltration occurs in the great majority of cases with very numerous actively motile spirochetes. Hoffman reports fairly successful results in guinea pigs by an almost similar technique (*Deut. med. Woch.*, 1910, xxxvi, 1025.)

Glycogen Loss, Hypoglycemia, and Muscular Weakness in Morbus Addisonii.—In a previous communication, PORGES (*Ztschr. f. klin. Med.*, 1909, lxxix, 341) has reported a striking hypoglycemia after removal of the adrenals. Now he (*Ztschr. f. klin. med.*, 1910, lxx, 243) reports the effect upon the glycogen content of the liver and muscles. Seven dogs were killed at intervals of four and one-half to eight hours after removal of the adrenals. At this time all showed great muscular weakness.

Their livers contained an average of 0.722 per cent. glycogen. If one animal be excluded, the average of the other six was 0.222 per cent. Schöndorff found 18.69 to 7.3 per cent. of glycogen in the livers of normal dogs on a similar diet. The muscle content of glycogen was 0.653 per cent. compared with Schöndorff's average of 4 per cent. In three dogs dying spontaneously after operation, the livers contained no glycogen whatever, the muscles an average of 0.187 per cent. The lack of glycogen is the cause of the hypoglycemia. The muscular weakness is in all probability due to lack of sufficient sugar and sugar-producing material; for muscle glycogen is well known to be far less readily available for the body than is the liver glycogen. This falls into line with the well-known sugar craving after severe muscular activity; and with Weiland's determination (*Deut. Arch. f. klin. Med.*, 1908, xcii, 223) of a hypoglycemia during the period of muscular exhaustion after prolonged work.

POLLACK (*Arch. f. exper. Path. u. Pharmak.*, 1909, lxi, 149) has shown that adrenalin glycosuria is due to the conversion of liver glycogen into sugar. He has also shown that in animals rendered glycogen-free by starvation and strychnine poisoning, adrenalin injections cause a new formation of glycogen and sugar. EPPINGER, FALTA, and RUDINGER (*Ztschr. f. klin. Med.*, 1908, lxvi, 1) have found in pancreatic diabetic animals an increased glycosuria and D : n ratio after adrenalin injection, indicating a carbohydrate-forming action. Porges believes that with extirpation of the adrenals carbohydrate formation ceases. If, as other as yet unpublished experiments have led him to think, all protein and fat must be converted into carbohydrate before being available for body fuel, then extirpation of the adrenals destroys the ability of the body to convert potential into kinetic energy. A second possible explanation deals with the internal secretion of the pancreas, which tends to convert sugar into glycogen, glycogen into fat. Equilibrium is normally maintained by the counteracting influence of adrenalin, but when this is withdrawn the body glycogen is rapidly lost. Be this as it may, "one can almost estimate the glycogen content of the liver by the degree of muscular weakness exhibited" by these animals.

Simplified Blood Culture.—In the taking of blood cultures in private practice we are greatly hindered by the antibacterial action of the blood. This makes it necessary to dilute the blood with large quantities of media at once. The convenience and lessened danger of contamination are so great that Schottmüller and Lenharz advocate the far simpler technique of collecting blood in sterile flasks, defibrinating at once by shaking with glass beads, and making transplantation to media in the laboratory. But the percentage of positive findings is much less. MYERSTEIN and ROSENTHAL (*Münch. med. Woch.*, 1910, lvii, 1432) show the importance of this antibacterial action. From fresh blood-bacterial mixture, plates made at once gave 47 colonies; those made immediately after defibrination, 21; those after four hours at room temperature, 5; after six hours, 1; and after twenty-four hours, no colonies NaCl in 5 per cent. strength stops coagulation and also largely or entirely inhibits the antibacterial action of blood. Myerstein and Rosenthal after adding 0.5 gram NaCl to 10 c.c. of blood-bacterial mixtures found an almost constant, sometimes very marked, increase in the num-

ber of colonies obtained on making plates. In most instances there was a progressive rise in the number of bacteria. Micrococci, pneumococci, streptococci, *Bacillus coli*, and *Bacillus typhosus* were tested. They recommend the dry sterilization of Erlenmeyer flasks containing 0.5 gram NaCl in substance. This is sufficient for 10 c.c. of blood. Transfer to media can be made when desired, and after twenty-four hours will give as many, if not more, colonies as if made at once.

A Metabolism Test for Gout.—Burian and Schur have shown that of the uric acid produced from intaken purin bases, 50 per cent. is excreted in the urine. Block found little variation for the same individuals, but that in different patients the rapidity of excretion varies considerably. In normal patients on a purin-free diet, the uric acid output returns to its original endogenous level usually within three, always within five, days after a single dose of purin bases. HÖSSLIN and KATO (*Deut. Arch. f. klin. Med.*, 1910, xcix, 301) have used this test to distinguish gout from other forms of arthritis. In all cases they determined the uric acid output on a purin-free diet, and then after giving 1 to 1.5 grams of sodium nucleinate. In two of the three gout cases the uric acid was still high on the seventh day. The third case at first showed no prolongation of the total excretion time, but the maximum excretion was retarded, occurring on the second day after the injection. On retesting this case, a definite prolongation of excretion time was found. In none of the other forms of arthritis was any abnormality in uric acid excretion found. The gout cases tested were not extremely pronounced. In one, the clinical diagnosis was only cleared by a typical joint which developed after the laboratory findings had been made.

The Inhibition of Exudate and Transudate Formation by Calcium Salts.—CHIARI and JANUSCHKE (*Wien. klin. Woch.*, 1910, xxiii, 427) have tested experimentally the power of calcium to inhibit exudate and transudate formation in animals. In dogs, the intravenous injection of 0.8 gram of sodium iodide per kilogram of body weight is fatal; a constant autopsy finding is an accumulation of fluid in the pleural and pericardial sacs. Thiosinamin has a similar effect. A like result is obtained in guinea-pigs following the injection of diphtheria toxin. The authors have treated dogs and guinea-pigs with the above-mentioned substances, one-half receiving the poisons alone (controls), the second half being given subcutaneous injections of calcium chloride in addition. Without exception, the animals treated with calcium showed no effusions into the pleural and pericardial sacs, while the untreated animals constantly had fluid in excess. Treatment with calcium chloride also had a marked inhibiting effect on oedema caused by the application of mustard oil to the conjunctiva of the rabbit. The authors suggest that calcium salts be tried in the treatment of pleural and pericardial effusions in man.

The Absorption of Pleural Exudate after Exploration and Puncture.—LEVY-VALENSI and POUZIN (*Bull. et mém. de la Soc. méd. des hôp. de Paris*, 1910, xxvii, 3 s., 265) describe the effect which is produced on pleural effusions by the withdrawal of very small amounts in exploratory

tappings. In seven cases of pleural effusion they took out amounts of fluid varying from 10 to 20 c.c., and in five instances the remaining effusion began to be absorbed quickly, so that the signs had almost disappeared inside of a week. In one of the two unsuccessful cases the withdrawal of 500 c.c. of fluid was shortly afterward followed by a reaccumulation. On the other hand, when absorption followed exploratory puncture the fluid never returned. On account of the simplicity and harmlessness of the method, the authors believed it to be well worth using in cases in which the symptoms are not urgent.

SURGERY.

UNDER THE CHARGE OF

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A New Treatment for Burns.—NEUMAYER (*Deut. Ztschr. f. Chir.*, 1910, clv, 615) says that the three most important indications to be met in burns are: (1) To alleviate the intense pain, (2) to favor the quick and smooth covering of the burned area with new skin, and (3) to prevent as far as possible the occurrence of infection. Neumayer believes that we have found in Klapp's chirosoter a means which meets these indications and that it is very simple and cheap. In burns of the first degree the solution is simply sprayed on the area covered by the burn and a sterile dressing applied. In burns of the second degree the vesicles are cut away completely with scissors and forceps and their contents removed by washing with normal salt solution. The whole area of the burn is then sprayed with the chirosoter and a sterile dressing applied. In burns of the third degree all sloughs that are not hanging loosely are allowed to remain in place and the burn is sprayed and dressed as in the other varieties. All loosely attached necrotic shreds are removed entirely, and all discharge washed away with salt solution. When all sloughs are separated healthy granulations are usually present and exuberant granulations rare. The first dressing is allowed to remain several days, this being determined by the amount of wound secretion. Neumayer has employed this treatment in 30 cases with marked success. The first effect of the spraying is to produce some burning, but almost immediately afterward in most cases the pain passes off. When the pain still gives trouble, alypin is added to the chirosoter, in the strength of a 1 per cent. solution, and this gives complete relief from pain. It is claimed for this treatment that a smooth, almost invisible scar results, usually without a tendency to contraction. Con-

traction did occur in one case, but its effects were overcome with light gymnastics. The treatment is especially valuable where two burned areas lie against each other, since it prevents their adhesion. To recommend it are its simplicity, cheapness, avoidance of infection, accelerating influence on healing, favorable effect on cicatrization, and ameliorating effect on pain.

The Diagnosis and Treatment of Unilateral Hemorrhagic Nephritis.—FRONNEHTÉINE (*Ann. d. mal. d. org. gén.-urin.*, 1910, xxviii, 1, 897) says that one of the most serious symptoms of genito-urinary disease is hematuria. The presence of blood in the urine is the first symptom which attracts the attention of the patient and causes him to seek assistance from a physician. Fronnehtéine reports the case of a patient, aged thirty-two years, who entered the hospital on account of abundant hematuria which had lasted for a month. The hematuria was accompanied by constricting pain in the right side of the upper abdomen. The father had suffered from nephritis and one of his brothers had had blood in his urine. Cystoscopic examination showed that the blood was coming from his right kidney. In the presence of profound anemia and the failure of medical treatment nephrectomy was performed. The results of operation were very satisfactory. The removed kidneys presented the changes of a hemorrhagic nephritis. Abundant hemorrhages arising from the kidney depend always upon an anatomical lesion of the renal parenchyma, and there can be no hemorrhage without an anatomical lesion. Insignificant anatomical changes may be the cause of abundant renal hemorrhages. An acute hemorrhagic nephritis may be bilateral or unilateral, and in the latter case it ought to be differentiated, under the name of hematuric nephritis, from cases of hematuria due to tumor. Israel's symptom, that is, the presence in the urine of vermiform clots, occurs especially in hematuric nephritis, and in this condition surgical intervention is indicated.

The Representation of Hypertrophied Prostate by the Skiagraph.—BÜRCKHARDT and FLOERCKEN (*Deut. Ztschr. f. Chir.*, 1910, cv, 110) say that the condition of the middle lobe and the anatomical relations of the hypertrophied prostate to the bladder often make the diagnosis difficult. Palpation through the rectum, as a rule, fails completely, and the use of an inflexible sound often fails to give reliable information. The use of the cystoscope is rendered difficult by the projection of the prostate into the bladder and by the presence of infection. These writers have already called attention to the value of filling the bladder with oxygen for cystoscopy and radioseopy. It is striking how distinct in form and size foreign bodies in the bladder are shown on the x-ray plate when oxygen is employed to fill the bladder beforehand. This is accomplished either with a catheter directly from the oxygen tank or by means of a 3 per cent. peroxide solution in a flask with potassium permanganate added. From the flask the developing oxygen is passed through the catheter into the bladder. The introduction of the oxygen is stopped as soon as the filling of the bladder is indicated by a feeling of slight tension on the part of the patient. The bladder should be emptied thoroughly before it is filled with the oxygen. A two-way catheter may be employed with one way closed until the oxygen is being

introduced, when through the other opening any fluid in the bladder may be slowly evacuated. The skiagram then taken with the use of a compression apparatus will give very distinctly the exact contour of the bladder and any change in it produced by a projecting portion of the prostate at the neck of the bladder. Six illustrations are given, showing very well the effect of the oxygen in outlining the limits of the bladder and the isolated hypertrophy of the middle lobe. This method may be of advantage in deciding the operation to be performed.

Inflammatory Tumors of the Sigmoid Flexure.—ARNSPERGER (*Mitt. a. d. Grenzgeb. d. Med. u. Chir.*, 1910, xxi, 557) refers to a case seen twelve months before, in which a diagnosis of carcinoma of the sigmoid flexure was made. The growth was excised successfully and the examination of the specimen showed that it was inflammatory in nature. Recently a second case was observed, in which at postmortem, the diagnosis of carcinoma was made, and only by a microscopical examination was its inflammatory nature established. A third patient operated on died and the microscopic examination showed the tumor to be inflammatory and to be formed about a number of diverticula filled with pus, one of which had perforated. The greater number of the circumscribed and localized chronic inflammations of the large intestine are specific and most of them tuberculous in nature. The place of election for their occurrence is in the cecum near the ileocecal valve, although the localized tuberculous disease is found in the sigmoid flexure. Localized subacute and chronic inflammations with the formation of large tumors occur in the sigmoid and are sharply defined from the sound portion of the bowel. They are hard in consistency, with an inclination to adhesions to the surrounding structures, and clinically resemble carcinomas completely. In connection with specific disease and inflammation about a diverticulum, there occurs a simple process which localizes itself in the subserous tissues and sets up a dissecting infiltration. The mucous membrane remains intact, the muscularis hypertrophies, and stenosis may be absent. Because of the impossibility of distinguishing, clinically, between such an inflammatory tumor and a carcinoma, resection of the diseased portion is indicated whenever it is possible. When there is marked stenosis, a very acute inflammatory condition, or the tumor is inoperable, colostomy is indicated. In all doubtful cases an exploratory laparotomy should be done and a piece of the tumor should be removed for microscopic examination.

Concerning the Etiology of Myositis Ossificans.—EWALD (*Zentralbl. f. Chir.*, 1910, xxxviii, 771) says that it is generally admitted that the bone formation in myositis ossificans is found only in certain muscles, as the brachialis internus and quadriceps femoris, especially in the vastus externus portion, and very rarely in the gluteal muscles, deltoid, coracobrachialis, and masseter. Numerous causes have been offered, but there is no explanation of why the process showed such predilection for these two places, while all parts of the trunk and extremities are frequently exposed to wounds and contusions. It is always found near joints. Ewald refers to a case of an acquired dislocation of the

hip in a forty-year-old-man, in whom the x-rays showed the separation of a small piece of bone which with its attached periosteum could explain the bone formation directly about the neck of the femur, but was not sufficient to explain the extensive area of new-bone formation involving all the muscles posterior to the joint and the ileopsoas. Three months after the accident the x-rays showed a large shadow above and below the femoral neck. Ten months later most of this had disappeared. Ewald believes that the synovial fluid is responsible for the condition found. It passes between the muscle fibres and accounts for the shell-like construction of the new-bone formation, by irritation of the intestinal connective tissue in the muscle. This theory is confirmed by the frequent recurrence after too early operation, as well as the finding of cysts in the mass filled with clear amber fluid, resembling synovial fluid. Myositis ossificans develops in broad fleshy muscles lying over the wounded joint and considerably torn.

The Action of Radium on Hypertrophy of the Prostate.—The editor of the *Amer. Jour. Urology*, 1910, vi, 249, in discussing the work of Desnos on this subject, says that three distinct rays are given off by radium, and are designated as A, B, and V rays. The A rays affect the superficial tissues intensely, but penetrate only slightly. The B rays, which are far more numerous, are divided into the soft, medium, and hard, and possess an elective action on certain tissues. The V-rays, which are far less numerous, have a very marked penetrating power. It is easy to filtrate the various radium rays by the interposition of metallic or other screens. The metallic screens decompose the B rays, which give rise to secondary rays. Superficial rays, only slightly irritant to the surface of penetration and acting on the deep-seated structures very slowly, necessitate a rather prolonged application. The non-metallic substances, such as rubber or thick paper, arrest the soft A and B rays, and allow the V and hard B rays to pass through. Desnos reached the prostate through the rectum and urethra, carefully protecting the mucosa by very simple instruments. In the rectum he used a large rubber tube, not perforated. A small silver cylinder containing the radium is passed into the tube and the thin wall of the tube brought into contact with the prostate. In the urethra sounds are passed, in the ends of which, under a gum varnish, is placed a piece of lead or aluminum, in the concave portion, so that the anterior portion of the urethra is protected. The urethral route is far more efficacious than the rectal. Twelve applications is the minimum, but often fifteen to twenty are necessary. The minimum interval is forty-eight hours, three or four days or sometimes longer being necessary. The indications for prostatectomy remain, the application of radium representing merely a palliative treatment. It is particularly adapted to prostates of medium size, where the hypertrophy involves the lateral lobes. Of 16 prostaties submitted to treatment, Desnos obtained no improvement in 3, while in the 13 others an improvement or a cure was obtained, and no complication occurred during the treatment. Five times the retention completely disappeared after from twelve to fifteen applications. It occurred gradually in 2 cases, while in 3 others it suddenly disappeared within eight days, and the result has been maintained respectively eight

months, seven months, six and a half months, and four months. In none of patients was any change in the size of the prostate made appreciable by rectal examination, but a softening of the gland was almost always noted. But it is well known that in the production of retention the most important element is the increased vascular development and congestion. Generally speaking, radium possesses an influence on the congestive phenomena, and in several patients the large and intense red projections surrounding the neck of the bladder covering the prostatic projections have been seen to disappear by the aid of the cystoscope.

A Contribution to our Knowledge of Carcinoma of the Stomach.—MATTI (*Deut. Ztschr. f. Chir.*, 1910, clv, 425) makes an extensive study based upon 19 cases of carcinoma ventriculi, and one with a considerable hyperacidity and ulcer of the stomach, complicated by a peptic ulcer in the afferent loop of the jejunum, after a Y-formed gastroenterostomy according to Roux. The affected portion of mucous membrane taken for study was removed from the region of the anastomosis in some cases, while in the remaining cases it was taken from the extirpated portion of stomach. Matti studied, particularly, the relation between the gastric carcinoma and the preceding changes in the mucosa. He distinguishes five groups of cases: (1) In some cases the chronic gastritis with atrophy of the glandular parenchyma is a completely independent condition and is due to one or several of the known causes of chronic gastritis. Its presence with a simultaneously existing gastric carcinoma is only accidental. (2) In other cases the carcinoma has developed in an area of chronic, atrophic gastritis, that is, upon a degenerated mucous membrane. To this group belongs the large number of gastric carcinomas with achylia. (3) There can be no doubt that a gastric carcinoma situated at the pylorus and extensively ulcerated, through the damming back of gastric contents and the foul secretion of the ulcer, may damage the mucous membrane and produce pathological changes in the interstitial tissue as well as in the glandular parenchyma. In some cases this local cause is the most important factor in the production of the chronic changes in the mucous membrane. (4) Combination forms of the preceding types may occur. (5) A carcinoma developing upon a simple ulcer shows only insignificant changes in the gastric mucosa, and often only in the early stages. In the late stages of a carcinomatous ulcer, we may find interstitial gastritis and glandular atrophy, as in patients with chronic simple ulcer, which has led to stenosis of the pylorus. The damage to the specific glandular parenchyma, however, is less intense than in a case of "primary" gastric carcinoma. This slight effect of the tumor upon the remaining mucous membrane depends upon the morphological peculiarities of the growth. When we consider that a simple ulcer, even when it has existed for years, produces no changes in the mucous membrane, at the most only an increase of the superficial cells (the most resisting form of stomach cells), we better understand why a carcinoma originating in an ulcer is more rarely associated with any considerable changes in the mucous membrane, than a "primary" carcinoma. In gastric carcinoma with achylia, the insufficiency of hydrochloric acid and the deficient production of enzymes, is characterized anatomically by the picture of

chronic gastritis with degenerated and atrophic processes in the region of the specific glandular parenchyma. An important role is played, evidently, by the substitution of intestinal glands for gastric. The parallelism between the condition of the mucous membrane and diminished gastric secretion is established completely by Matti's material. Hammerschlag's and Boeckel's investigations establish the same fact.

Hemorrhages in Goitres.—BRUNING (*Archiv f. klin. Chir.*, 1910, xci, 614) says that in the great majority of goitre cases, dyspnoea, dysphagia, and cardiac disturbances develop gradually. There occur cases, however, in which the dyspnoea sets in suddenly and terminates fatally, like lightning out of a clear sky. He reports the case of a man who had a small goitre which previously had not given him the slightest disturbance. After firing several shots from a gun, in consequence of the recoil, the goitre suddenly increased in size and gave rise to considerable disturbance of breathing and of the circulation. Operation later established the presence of a small hemorrhage in the goitre. Hemorrhages occur in all kinds of goitres, most frequently in the colloid and cystic varieties. The bloodvessels in goitres are delicate and thin, so that from the slightest cause they are torn and lead to hemorrhage. This is realized readily by those who operate often on goitres. The vulnerability of the vessels depends upon a degeneration of their walls, probably an amyloid degeneration. The clinical symptoms result from the sudden increase in volume and the consecutive narrowing of the trachea. Pain and tenderness develop from the tense swelling. The sudden arrest of the current in the cervical veins and therefore in those of the goitre, from severe attacks of coughing in cases of tracheal and bronchial catarrh, gives rise to an internal pressure that ruptures the delicate vessels in the goitre. Severe muscular exertion or blowing on a cornet may produce a similar effect. External violence, direct or indirect, may give rise to the hemorrhages. When a patient with goitre is suddenly taken with an attack of "goitre asthma," it may be due to an acute catarrh of the bronchial tubes, an acute inflammation of the goitre or a hemorrhage into it. In tracheal catarrh there will be practically no changes in the goitre and the laryngeal mirror will disclose the condition of the mucous membrane. The inflammatory condition of the goitre is diagnosed from the hemorrhagic with much greater difficulty, especially in the early stages. Suddenness of onset speaks for a hemorrhage, especially if it is due to external violence. Fever comes earlier and is more characteristic in inflammation, as are oedema of the skin and redness. For the severe disturbances due to the sudden hemorrhage, operation is the best treatment, but if there is no immediate danger to life, operation may be delayed, and absorption of the hemorrhage hoped for. If operation is not done, absolute rest in the semirecumbent position, the application of an ice bag locally, milk diet, and morphine for the pain, are indicated. If the symptoms are threatening operation should be done very soon, since a second hemorrhage may occur at any time.

THERAPEUTICS.

UNDER THE CHARGE OF

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The Ehrlich-Hata Antisymphilitic Preparation "606" (Dioxy-diamido-arsenobenzol).—While from lack of sufficient data there are as yet few written reports upon the value of this new drug, yet in the discussions of medical societies an ever-rising enthusiasm marks the communications of Weichselmann, Alt, Kronmayer, Pick and Dörr. NEISSER, in an open letter to Ehrlich (*Deut. med. Woch.*, 1910, xxxvi, 1212) "can today say with absolute certainty that this new drug exerts an extreme, an astonishing action, as well upon the spirochete as upon the products of syphilis." He uses a single dose of 0.4 gram diluted in 20 c.c. of saline and given intravenously. The pain is far less than in intramuscular injection. No bad results follow. So far only 10 per cent. have shown a disappearance of the Wassermann reaction. SCHREIBER and HOPPE have now the most complete series to report (*Munch. med. Woch.*, 1910, lvii, 1430), 150 cases, of which at least 50 have now been followed for over two months. Technique: As the drug is only stable as a dichloride, it must be made up fresh each time. The single dose, 0.6 to 0.7 gram of the dichloride, is put in a 150 c.c. mixing cylinder, moistened with 0.5 c.c. of methyl alcohol, and then well shaken with 10 c.c. of sterile water. Sterile 1.24 per cent. NaOH is now added till after strong shaking very little undissolved residue remains; 3.5 to 4 c.c. more of NaOH is added, the amount made up to 60 c.c. with normal saline, and injected in doses of 30 c.c. into each gluteal region. The injection is very painful. Patients are kept in bed for four days and advised do little walking for some days. Abscesses have not developed. Intravenous injection of a smaller dose, 0.45 gram diluted to 80 to 100 c.c., has, in 30 cases, proved almost painless and satisfactory. One dose suffices. The general reaction is marked; fever to 102° is common, to 104° occasional; it lasts but a day or two. No injurious action on the kidney has been noted. Methemoglobin is not formed; there is no neuritis or other ill effects. The primary lesion shows definite decrease in twenty-four hours and spirochetes are usually absent after forty-eight hours. About secondary lesions a well-marked Hexheimer reaction is frequent. In 52 cases in which the Wasserman reaction was positive at the outset, 84.6 per cent. had a negative reaction within fifty days, and 92.3 per cent. became negative in all. This is apparently not due to any direct action of the drug upon the reaction.

The Treatment of Organic Nervous Diseases with Arsenic.—WILLIGE (*Munch. Med. Woch.*, 1910, lvii, 620) has had very favorable results with arsenic in the treatment of organic nervous diseases. He gave the arsenic by means of subcutaneous injections, using for this purpose a 1 per cent. solution of arsenous acid. He began with 1 mg. as an initial dose, and

gradually increased to 10 mg. After the maximum dose was obtained this was continued from three to eight days and then gradually diminished to the minimal dose. The arsenic was then discontinued for fourteen days and after that period resumed as before. He gives the details of 12 cases of multiple sclerosis treated by this method. Nine of these attained a considerable improvement. The improvement at first was mostly general, the patients gaining weight and strength. Following this general improvement there was a marked functional improvement especially as regards their ability to walk. The best results were observed in complicated multiple sclerosis without optic atrophy. No benefit was observed when the optic nerve was already involved. In 5 cases of polyneuritis and 12 cases of neuritis and paralysis of various origins this treatment seemed to effect a marked improvement. No benefit was obtained in one case each of spastic spinal paralysis, paralysis agitans, Friedreich's ataxia, pseudobulbar paralysis, lead poisoning, and hemiplegia. Six out of 10 cases of tabes showed a marked improvement in their general condition, and in 4 of these cases the lightning pains, girdle sensations, and gastric crises disappeared. None of these 10 cases, however, improved as regards their objective symptoms. Willige says that his results with arsenic lead him to believe that the long continued use of small doses of arsenic has a stimulating action upon nerve tissue.

The Effect of Coffee and Tea upon the Production of Uric Acid.—SCHITTENHELM (*Therap. Monatshefte*, 1910, xxiv, 113) believes that both coffee and tea increase the uric acid in the blood, and should be excluded from the dietary of gouty individuals, especially during an acute attack. He bases this belief upon experiments on dogs, the details of which he gives in his article.

The Dietetic Treatment of Cholelithiasis.—KOLISCH (*Med. Klinik*, 1910, vi, 531) believes that dietetic measures are very important in the treatment of cholelithiasis. The diet, according to Kolisch, should be so regulated that the liver is spared as much work as possible. Furthermore, it is important to keep the intestines active and free from catarrhal processes. He believes that intestinal catarrh may cause a similar inflammation in the gall-bladder. He ascribes the benefit derived from the Carlsbad cure to the effect upon the intestines of the Carlsbad waters. Kolisch forbids all highly seasoned foods, very acid foods, raw vegetables and fruits, fat and salted meat, any fat that does not melt readily, and any food that is prepared with yeast or other ferments. The fats that are allowed are oil, cream, and butter. The amount of protein should be limited and given in small portions throughout the day. Care must be taken to avoid protein containing a large amount of extractive or purin bodies. Cold drinks are forbidden, but hot drinks have as favorable an action as hot external applications. Kolisch applies hot fomentations to the abdomen for two hours after dinner every day for two or three months after an acute attack. He also forbids any active exercise for a year following the acute attack, during which time also the dietetic measures are to be kept up.

Autoserotherapy of Tuberculous Peritonitis.—EBLER (*Med. Klinik* 1910, vi, 627) reports a case of tuberculous peritonitis treated on the principles of autodrainage recently advocated for the treatment of hydrocephalus. He made a permanent fistula leading from the peritoneal cavity to the subcutaneous tissue through the separated recti muscles. The skin incision was closed tightly. The ascites was thus drained and the reabsorption of the fluid induced by an autoserotherapy. The patient improved rapidly, gaining 25 pounds in weight, and there was no return of the ascitis.

The Relation of Digitalis to the Bundle of His.—HARE (*Therapeutic Gazette*, 1910, xxvi, 244) points out that in valvular disease, especially mitral stenosis, a state closely allied or equivalent to partial heart block with jugular pulsation, frequently occurs. In other cases a state is produced like that of nodal rhythm. The clinical recognition of these conditions is most important because of the possibility of still further delay in the passage of the contractile impulse from the sino-auricular node over His's bundle by the action of digitalis. Hare, therefore, says that digitalis may be a very dangerous drug in mitral stenosis, since by its powers of diminishing auricular contraction through vagal stimulation, and by its inability to increase the power of the auricular wall, it may increase the danger of auricular distention by retained blood, and so paralyze this part of the heart. Furthermore, this tendency to distention of the left auricle is aggravated by the fact that digitalis stimulates the right ventricle to drive more blood into the left auricle, thereby still further distending that cavity. Hare cites the views of many well known observers of the mechanics of the circulation from which he draws the following deductions as to the use of digitalis in mitral stenosis: Given a patient suffering from circulatory failure due to mitral stenosis, it is our duty not only carefully to weigh the import of the tumultuous cardiac sounds, but by the use of instruments of precision to determine, if possible, whether there is delay in the transmission of the contraction impulse over His's bundle. If such a delay exists, digitalis in doses large enough to cause a distinct and sharp cardiac effect is probably capable of prolonging this delay and so doing harm. If, in addition to this delay there is a jugular pulse synchronous with ventricular systole, digitalis is still more contraindicated, as it will impair the action of the left auricle, and will still further distend it by stimulating the right ventricle. If given at all, the dose of digitalis must be so small as to produce a very gradual effect, one which will not consist in decreasing auricular contraction through vagal stimulation, but gently reestablish general cardiac power. In other words, here is another instance in which the question of a proper dose is as important as the choice of the proper drug. The question naturally arises: If not digitalis, what else? The answer would seem to be that in such a case as that just described, we should give the patient absolute rest, unload the portal system by free purgation, use venesection to relieve stasis, and give rapidly-acting diffusible stimulants for a few hours until the coordination of cardiac movement is reestablished. When this is done, then small doses of digitalis, arsenic, and iron may be used to restore cardiac tone.

Antityphoid Inoculation.—RUSSELL (*Bull. Johns Hopkins Hosp.*, 1910, xxi, 83) gives his conclusions as to the value of antityphoid inoculations based upon 3640 inoculations in the United States Army. (1) Vaccination against typhoid undoubtedly protects to a very great extent against the disease. (2) It is an indispensable adjunct to other prophylaxis among troops and others exposed to infection. (3) It is very doubtful if there is an increase of susceptibility following inoculation. (4) Vaccination during the disease, for therapeutic purposes, fails to reveal any evidence of a negative phase. (5) The statement that vaccination should not be carried out in the presence of an epidemic is not justified by the facts in hand. (6) The procedure is easily carried out and only exceptionally does it provoke severe general reactions. (7) No untoward results occurred in this series of 3640 vaccinations.

Thyroid Treatment in Epilepsy.—SIGMUND (*Med. Klinik*, 1910, vi, 702) reports a case of epilepsy occurring in a girl, aged nine years, in which certain evidences of thyroid insufficiency suggested that the epilepsy might be a result of defective thyroid functioning. The child was treated systematically by thyroid extract, and there has been a constant improvement for a period of two years.

Nutrient Suppositories.—POAS (*Berl. klin. Woch.*, 1910, xlvii, 617) has used with good success nutrient suppositories containing crystallized egg albumin, salt, and dextrin. Each suppository contains the equivalent of 46.2 calories. They are readily absorbed and four to five may be given in a day. Poas advocates their use in conditions in which rectal feeding is necessary.

PEDIATRICS.

UNDER THE CHARGE OF

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OF PHILADELPHIA.

Typhoid Epidemics from Ambulant Cases in Children.—G. BRÜCKNER (*Münch. med. Woch.*, 1910, lvii, 1213) has investigated the spread of typhoid fever by ambulant cases in children and also the proportion of children affected in a number of epidemics. While due weight must be given to the transmission of typhoid by water, food, and typhoid carriers, later investigations of epidemics show that personal contact stands foremost in the transmission of the disease. A number of epidemics have been reported as arising from contact infection alone. A rapidly culminating epidemic is usually caused by water or milk infection, whereas a gradually developing epidemic is caused by contact infection. It is proved that typhoid is spread by ambulant children with mild typhoid, often simulating indigestion, and with fever of a short duration. Koch has shown a number of instances of this kind especially in school

children. In epidemics a large proportion of children from one to ten years old are affected. Frosh cites 80 cases of typhoid, distributed as follows: From one to five years, 18 cases; from five to ten years, 35 cases; from ten to fifteen years, 27 cases. Meinicke and Schumacher report three epidemics. In the first epidemic, out of 64 cases, 43 were from one to fifteen years old; in the second, 52 cases showed 26 from one to fifteen years; and in the third, 51 cases showed 27 cases from one to fifteen years old. In Strassburg, from 1906 to 1909, there were 812 cases of typhoid: 324 cases, or 39.9 per cent., were from one to fifteen years old, 36.57 per cent. were from sixteen to thirty years, and 23 per cent. were over thirty years. One epidemic in a small town was shown to have started by a child with ambulant typhoid infecting its playmates, and resulted in the infection of 10 children and 4 adults. A second epidemic was traced to a child with ambulant typhoid, who was directly responsible for infecting ten playmates. In this epidemic, out of a total of 18 cases, 12 were children. In a third epidemic, a child in mid October developed a diarrhoea and slight fever, but had no medical attention. In mid November an explosive outbreak of typhoid occurred, 7 people on the premises falling ill at the same time and two playmates of the child living near by. The first child was then examined and gave a positive Widal reaction. This outbreak was caused by contamination of a well on the premises in cleansing the child's chamber close to it. A valuable lesson can be learned from these three small epidemics. All were caused by ambulant typhoid in children, and could probably have been avoided if the children had been at once isolated and their excrements properly disinfected. To summarize, from ten to fifteen years is the most susceptible age for contracting typhoid, and children from one to fifteen years form the main contingent of infections in epidemics. Typhoid in children is apt to be light, undiagnosed, and often untreated, and therefore especially dangerous. The ambulant type in children is often the starting point of a large number of cases and often of epidemics. The control and stamping out of these cases depends partly on the proper attention of medical school inspectors and teachers. Most important is it for the general practitioner to realize that the early years of childhood are disposed to this infection, that its course is mild and often taken for ordinary gastro-enteric trouble, and that each suspicious case should be isolated and a laboratory diagnosis established by examination of the blood and the stools.

A Theory of Insufficient Lactation.—Fock (*Münch. med. Woch.*, 1910, lvii, 1338) throws an interesting side light on Bunge's investigations as to the cause of insufficient milk secretion in nursing mothers. Bunge believes from his investigations that the milk secretion in the mother is diminished proportionately to the amount of alcohol her father had imbibed prior to her conception. Also that degeneration of the milk-forming glands is the sign of a generalized physical degeneration as shown by a vulnerability to disease, especially tuberculosis and dental caries. Dr. Fock's observation over a period of two years on the native born Bergdamara, Hottentots, and Bush tribes of German South Africa shows that in this period he has not found a single case in which a woman was unable sufficiently to nurse her child. Among these tribes, in fact, it is not rare to find children of two, three, and even five

years still taking the breast in conjunction with their regular food of meat, roots, onions, etc. If a nursing mother dies the grandmother puts the child to her breast, and in from four to eight days her breasts are secreting sufficient milk for the child, even though she has not borne children for many years. The above facts seem to agree with Bunge's theory, since these native-born tribes have been and still are practically free from the habit of imbibing alcohol. Fock suggests the value of a comparative investigation on native tribes who for several generations have used alcohol daily.

Tuberculous Mothers and Nursing Infants.—A. DEUTCH (*Münch. med. Woch.*, 1910, lvii, 1335) emphasizes the importance of investigating the relation between the tuberculous mother and the safety of the child she nurses, and also the effect of nursing on the course of the disease in the mother. In practically all text-books relating to the care of infants the advice is given not to allow a tuberculous mother to nurse her child. Biedert counsels against nursing by mothers with even incipient tuberculosis, and even when an hereditary tendency to tuberculosis can be shown in the family. Schlossman objects to nursing by mothers with well-developed or progressive tuberculosis, and counsels weaning as soon as possible; but when the disease is not well developed or progressive he allows the mother to nurse, so that the child, besides the danger of tuberculous infection which it runs anyhow, will not be laid open to the additional danger of an unnatural and unaccustomed food. If we grant the rarity of congenital tuberculosis; that an inherited disposition plays no rôle in very early childhood; that infection is conveyed by both ingestion and inhalation; and that nourishment, including cow's milk, plays a minor part as an infective agent as compared with close contact with a bacillus-shedding individual, then the decisive point is whether or not the breast milk of a tuberculous woman contains tubercle bacilli. The bacillus occurs in cow's milk, but experiments show that tuberculosis of the udder in cows causes most of the bacilli-containing milk, and that the milk from clinically tuberculous cows is free from bacilli. Tuberculosis of the mammary glands is rare in women, and to the author's knowledge tubercle bacilli have never been demonstrated in breast milk. Again, tuberculosis begins primarily in the mesentery of calves and household animals fed on milk, while in children the bronchial lymph glands are the first affected. Deutch examined 74 nursing mothers: 40 per cent. were free from tuberculosis; 25 per cent. had active processes of the disease, and the rest incipient or inactive. The effect of nursing on the tuberculous mothers showed that only rarely were they benefited, that most of them lost weight and were unbenefited, and that occasionally the effect was quite deleterious. On the other hand, birth and the puerperium in the widest sense did not seem to affect either the improvement or the stationary condition of the disease. The effect on the children was as follows: Out of 16 children nursed by mothers with active tuberculous processes, 5 were infected with, and 2 died of, tuberculosis. Out of 8 children nursed by mothers with inactive tuberculous processes, 2 were infected and 1 died of the disease. Four children born of mothers with active tuberculosis, but not nursed by them, were not infected. None of the children of tuberculous mothers, active or inactive, devel-

oped the disease if not nursed by the mother. The infected children all nursed from the tuberculous mothers, while the children not so nursed but also hereditarily tainted have so far remained well. Deutch concludes that breast milk does not carry the infection, but possibly contains substances which break down the child's resistance, infection then occurring through contact with the usually infected secretions.

Hereditary Hemolytic Icterus.—ERICH ASCHENHEIM (*Münch. med. Woch.*, 1910, lvii, 1282) reports two cases of hemolytic icterus in father and son. The family history is negative, there being five other children in good health and no chronic disease in the father's parents. The father's skin and conjunctivæ have been icteric since birth. There is a blowing systolic murmur at the apex of the heart, without hypertrophy. The spleen is very hard and extends to the level of the anterior superior spine of the ilium below, and to the right as far as the mid-abdominal line. The surface of the spleen is not smooth. The liver is moderately enlarged and extends almost two fingers' breadth below the costal margin. The urine is of a marked reddish color, and contains, in excess, urobilin and urobilinogen. The child has had icterus since its second year at least. This has been accompanied by weakness and an irregular fever, which still continues. The child is aged six and one-half years. One year ago there was bloody diarrhoea with marked increase in icterus and loss of weight. Examination reveals a moderate enlargement of the cervical and inguinal lymphatic glands. There is a slight fluctuating temperature. The lungs are negative and the heart shows a blowing murmur at the apex and a prominent pulmonary second sound. The spleen is very hard and much enlarged, reaching the level of the anterior superior spine of the ilium below, and the midabdominal line to the right. It is freely movable, smooth, and not tender. The liver is enlarged and extends three fingers' breadth below the costal margin, and shows increased resistance on palpation. The urine has a marked reddish color, contains an excess of urates, urobilin, and urobilinogen. The blood examination showed diminished hemoglobin and some reduction in the number of red blood cells; marked alteration in the size of the red blood elements, megaloblasts, microcytes, poikilocytes, nucleated red cells, and some granular degeneration of the red cells being present. The number of white cells was very slightly increased. The blood serum was yellowish in color and negative for bile-coloring matter. The blood finding in the father practically coincided with that of the son. The two cases are, therefore, practically identical, with the exception of the irregular fever in the case of the son, which was absent in the father. Aschenheim thinks that the condition of the red blood cell elements might be caused by some upset condition of the bone marrow. He concludes by accepting hemolytic icterus as a primary disease of the liver, but believes it possible that an unchecked hemolytic icterus through bile stasis in the smallest bile capillaries may lead gradually to cirrhosis of the liver.

OBSTETRICS.

UNDER THE CHARGE OF

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Ovarian Tumor Complicating Pregnancy, Labor, and the Puerperal State, with Notes of Eight Recent Cases.—MARSHALL (*Jour. Obst. and Gyn. British Empire*, February, 1910) reports eight cases of ovarian tumor complicating pregnancy. One was a primipara having a tumor of the right ovary prolapsed into Douglas' cul-de-sac. The pregnancy was at the end of the second month. The tumor was removed by abdominal section and the pregnancy remained undisturbed. The second case was a primipara in whom ovarian tumor was diagnosed as complicating pregnancy at the ninth month. The patient was examined when four months pregnant, but a correct diagnosis was not made, as the tumor lay centrally over the fundus of the uterus and obscured palpation. When the diagnosis was made, operation was advised and refused. Spontaneous labor took place three days later without difficulty, and the puerperal period was uneventful. The author does not believe, that pregnancy stimulates the growth of ovarian tumors, as the blood supply of these tumors is independent of the uterus. He has collected 137 cases published since 1903, in which ovarian tumors were removed during pregnancy, with one maternal death after the removal of a suppurating cyst, and an abortion rate of 15.1 per cent. Dermoids, which form 25 per cent. of ovarian tumors, are especially dangerous in pregnancy, from their tendency to prolapse into the pelvis, to suppurate, and to have twisting of the pedicle. In operating during pregnancy Marshall would choose the abdominal route, incising over the left rectus, turning the muscle outward, and closing the wound in four overlapping layers. He would avoid incising the median line from the danger of hernia and the bursting open of the wound. Tumors impacted in the pelvis should be removed in the same way. Occasionally, if the tumor be densely adherent, it may be necessary to resort to Cesarean section. To avoid abortion it is considered important to ligate the vessels in the pedicle separately on each side by undersuturing, to handle the uterus as little as possible, and to keep the uterus and abdominal tissues warm by a large pad wrung out of hot saline solution. Marshall has collected 26 cases of ovarian tumor complicating labor. In these, reposition was tried six times, but failed in four; forceps was used twice, in one case the tumor bursting, and in the other the tumor being driven through a rent in the posterior vaginal wall with a fatal result to the mother. Version was performed four times, and proved difficult. Three children were lost and one mother died. Operation was performed in 18 cases, abdominal ovariectomy in 7, vaginal ovariectomy in 4, Cesarean section in 7. One mother on whom forceps had been tried for two hours before the section died after Cesarean delivery. The children survived with one exception, this child being asphyxiated by coiling

of the cord. The author reports the case of a primipara who had been in labor for several hours, the membranes having ruptured, but the pains were not severe. On vaginal examination the whole pelvis was filled with a hard, immobile tumor, in which could be felt a plate of bone, leading to the diagnosis of dermoid cyst. On section, the uterus was turned out and wrapped in a warm towel. The tumor was delivered with some difficulty and its short broad pedicle ligated. The uterus was replaced and the abdomen closed in layers. It was difficult to apply sutures, as the uterus was contracting and pressing forward against the abdominal wall. Labor proceeded favorably, the patient being delivered by forceps as soon as dilatation was complete. The patient made an uninterrupted recovery. Marshall has also operated upon five cases during the puerperal period. Recovery in these patients was uncomplicated. Regarding the treatment of this condition, early operation is indicated as soon as the tumor is diagnosticated. If recognized during labor, if the position of the tumor permits it, labor should be allowed to go on and the tumor removed during the first week of the puerperal period. If the tumor has been punctured or incised through the vagina to permit labor, section should be done not later than the second day of the puerperal period. If torsion, followed by urgent symptoms develops, immediate operation is demanded. On the whole, early operation should be urged in these cases.

After-results of Abdominal Operations.—In recent numbers of the *Journal of Obstetrics and Gynecology of the British Empire*, GILES has published the after-results of abdominal operations upon the pelvic organs, based on a series of 1000 consecutive cases. He summarizes his investigations in the July, 1910, number. These statistics are of interest to obstetricians who are frequently called upon to perform abdominal delivery or operate for infective conditions in the generative organs. It was found that 90 per cent. of patients were considerably improved in general health after the operation, 72 per cent. being in quite good health. In 6 per cent. patients were not improved and possibly worse after the operation, but in many of these cases the cause for ill health was independent of the operation. Four per cent. were much better after the operation for a time, but then were worse because of general ill health from some other cause. It was interesting to note the time occupied in recovery after abdominal operations in most cases. Sixty per cent. were practically well in three months, 10 per cent. at the end of the first year, and 30 per cent. remained invalids or semi-invalids. In the question of complete recovery the age of the patient had a marked influence—the younger the patient the quicker the convalescence. The severity of the operation did not seem to have any real influence upon the rapidity of convalescence. In one respect, however, the duration of an operation seemed to influence the convalescence of the patient, for it was observed that memory was affected in 25 per cent. of cases, and these were those in which the operation was a long and difficult one. In long operations for cancer of the womb, memory was affected in 50 per cent. of cases. In short operations for correction of uterine displacements, memory was affected in 18 per cent. only, while other operations showed corresponding results. Secondary or repeated operation was necessary in 8.3 per cent. This was espe-

cially true in cases of inflammatory disease of the appendages, while half of the secondary operations were required for conditions independent of the first operation. As has been observed by many, the necessity for repeated operation is most often seen in cases in which one tube and ovary are removed, this amounting to 9.5 per cent. When conservative surgery was practised in removing but one tube and ovary, and when operating upon the uterus, the results were good, so far as the possibilities of pregnancy were concerned. In one-third of married women under forty, having these operations, pregnancy subsequently developed; 73 per cent. of these went to full term, and ectopic gestation developed in 8 cases. Labor in these cases was normal in 55 out of 60, while 5 had complications which had no reference to the operation. Operation then does not seem to have an influence in producing complications in labor. By far the greater majority, 88 per cent., had no trouble with the scar; 7.7 per cent. had stitch abscess, and 3.6 per cent. hernia. These complications were seen more often after operation for inflammatory disease. Stitch abscess is much less common with modern technique, and especially with the use of rubber gloves.

Tuberculosis of the Placenta.—SCHLIMPERT (*Archiv f. Gynäk.*, 1910, Band xc, Heft 1) reports the results of examination of the placenta for tuberculosis in Schmorl's clinic in Dresden. In 7 cases of tuberculous mothers the placenta was positively found tuberculous in 5 through histological examination and the detection of tubercle bacilli. In 1 case tubercle bacilli were obtained by the stroke method. Thus, in 85.7 per cent. of tuberculous mothers the placenta was found tuberculous; in 5 of the cases the placental tuberculosis was intervillous, and in 3 the decidua was infiltrated with bacilli and round cells; in 2 cases where tubercle bacilli were recognized by stroke preparations, the form of tuberculosis was probably intervillous. These placentae were obtained from mothers who had severe general and advanced tuberculous infection. There is reason to believe that the tubercle bacilli pass in the early months of pregnancy from the tuberculous mother to the placenta. In all, the results were positive in 10 cases, of whom, 2 were studied by the stroke method. Schlimpert believes that tuberculosis of the placenta is a reaction of the maternal organism against tuberculous infection. There is no reason to believe from his researches that tubercle bacilli find their way from mother to foetus. Autopsy made upon children dying of tuberculous mothers fails to find macroscopic evidence of the disease. It is possible that such children die from a toxin which is not readily detected. Recent observations point to the possibility of foetal infection, and further investigation must be undertaken before the question is definitely settled.

Infection of the Urinary Tract with *Bacillus Coli Communis* during Pregnancy.—BURNETTE (*Jour. Obs. and Gyn. Brit. Emp.*, July, 1910) reports 4 cases with infection of the urinary tract during pregnancy with *Bacillus coli communis*. One was a primipara pregnant four months, in whom the symptoms were those of acute appendicitis. There was a wide area of excessive superficial tenderness over the right kidney on the posterior aspect. The urine showed *Bacillus*

coli communis in pure culture, the right ureter was abnormally thickened and tender, the patient had a chill with abdominal pains followed by fever. Under appropriate medical treatment the patient recovered. The second case was that of a multipara, whose symptoms resembled those of pleurisy at the base of the right lung, and careful examination showed *Bacillus coli* infection of the right kidney. The patient was delivered by forceps under careful antiseptic precautions, and on the tenth day thrombosis of the veins of the lower extremity developed. Examination of the contents of the uterus showed *Bacillus coli communis* as the cause of the infection. The renal symptoms did not entirely subside in this case during pregnancy, but the patient ultimately made a good recovery. A third case was that of a primipara who became so ill that nephrotomy was decided upon. While preparations were being made for operation the patient had a twin abortion, after which she recovered. The fourth case of a primipara recovered under the usual medical treatment.

GYNECOLOGY.

UNDER THE CHARGE OF

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The Treatment of Inflammatory Disease of the Adnexa with Intrauterine Injections.—ZWEIFEL has proved conclusively that following intrauterine injections of a methylene-violet solution, the fluid escapes from the abdominal ostium of the tubes in almost every case. Based upon this fact, he conceived the idea of treating inflammatory diseases of the tubes by making an intrauterine injection of some bactericidal solution. Erich Aulhorn (*Archiv für Gynäk*, 1910, xc, 15) reports the results of this treatment as carried out in the Zweifel clinic at Leipsic. For this purpose he uses a 2 per cent. solution of argentamine which is non-irritating and antigonorrheal. One hundred and twenty-three cases were treated, the lesions varying from simple salpingitis and perisalpingitis to pyosalpinx the size of a fist. In classifying his primary results, he divides them into two groups, the relief of pain and alterations in objective findings. Under the first heading 108 (88 per cent.) were completely relieved; 7 markedly improved, while in 8, slight or no improvement was obtained. Based upon the objective findings, 89 (72 per cent.) were cured; 16 showed marked improvement, in 18 there was little or no improvement, and the condition was exaggerated in 1 case. Of the pyosalpinx cases he reports 86 per cent. cures. The alterations produced in pyosalpinx are due to an active hyperemia induced as the result of the injections. He reports further his end results as follows: Thirty patients were examined who had received no treatment for one year to nineteen months, of which 84 per cent. were cured; 20 patients after six months to one year, with 82 per cent. cures; and 26 patients after three to six months, with 76 per cent. cures. Of this number 5 have

become pregnant. In the presence of acute infection or objective symptoms the treatment is contraindicated. He also withholds the injection in the presence of fever. The first three or four injections must be made slowly and under little pressure on account of the pain produced. The subsequent injections are, as a rule, painless and greater pressure can be employed. The amount injected varies from 1 to 2.5 cubic centimeters. In severe cases the pain following injection was so severe as to demand morphine. The treatment is applied daily.

Dysmenorrhœa in Nulliparous Women without Gross Pathological Lesions.—C. C. NORRIS and E. P. BARNARD (*Amer. Jour. Obstet.*, 1910, lxi, 753) divide the causes of dysmenorrhœa into three groups, general, failure of development, and stenosis of the cervix. Of general causes, tuberculous is perhaps the most frequent. The failure of development may involve the entire genital tract or may be limited to the ovaries, which present a thickened capsule making difficult the rupture of the Graafian follicle. The whole uterus may be undeveloped, or as is more frequently encountered, the cervix is long and taperoid with a small corpus. Stenosis of the cervix, per se, is rarely accountable for dysmenorrhœa, since the great majority of cases will admit a sound. It is the stenosis plus the excessive clotting properties of the blood which causes incomplete drainage, with consequent painful uterine contractions. Coagulation within the uterine cavity is favored by the presence of shreds of endometrium. Successful treatment demands painstaking efforts to identify the underlying cause. The purely congestive type is not relieved by operation. General treatment may give relief, but at best, the prognosis is unfavorable. The prognosis must be guarded when the congestive and expulsive types are combined. The expulsive or obstructive type yields readily to operation. After considering the various types of operation applicable to this condition, the authors report the results obtained in forty patients operated upon in the gynecological clinic of the University of Pennsylvania.

Histological Studies on the Influence of Roentgen-rays upon the Human and Animal Ovaries.—REIFFERSCHIED (*Zentrbl. für Gynäk.*, 1910, 593) states that in white mice marked degenerative changes were produced in the follicular epithelium, with destruction of the ovum. Whether the stroma undergoes alteration after the application of small doses was not definitely proved, although certain preparations seemed to show that such did take place. In large doses there was complete destruction of the ovarian tissue. He examined further the ovaries of a monkey and found practically the same changes as in the white mice. The primordial follicles were especially affected; in them the degenerative process was more extensive in the ovum than in the follicular cells. In the larger follicles the ovum was often intact, while the follicular epithelium showed advanced degeneration. Lastly, he reports his findings in the ovaries of six women, who had been subjected to the rays prior to operation. The primordial follicles were the seat of extensive degeneration; the follicular epithelium was in some cases unaffected, while in others it was the seat of degeneration or complete destruction. The degenerated ovum sometimes showed the germinal vesicle; mostly, however, this had disappeared. In the larger follicles he found all

stages of degeneration of the epithelium. Graafian follicles were seldom seen, but when present the epithelium was intact. At the site of the ovum was only a hyaline mass or the ovum was floating free in the follicle and presented the signs of degeneration. Only rarely were the germinal vesicle and germinal spot recognizable.

The Evidence Afforded by Bacteriological Examinations for Treatment of the Wound in Abdominal Operations for Carcinoma of the Uterus.—At the Gynecological Congress in Dresden in 1907, Liepmann reported the results of his bacteriological examination made at the time of operation, especially in cancer of the uterus. In many cases streptococci were demonstrated in the parametrium, which foretold with certainty the death of the patient from septic infection. In a second paper (*Berl. klin. Woch.*, 1908, No. 22) the results of his examinations prove conclusively the value of vaginal drainage after carcinoma operations. In 30 cases in which no drainage was employed the mortality was 36.6 per cent.; while in 23 drainage cases it was 43 per cent. WALTER HANNES (*Ztschr. für Geburt und Gynäk.*, 1910, lxxvi, 150) reports a reduction of mortality from 30 to 40 per cent. to 21 per cent. by the use of the vaginal drain. The report is based upon 43 cases, 30 of which were for carcinoma of the uterus operated upon in Kuster's clinic at Kiel. After describing his technique, he details the clinical course and bacteriological findings in two series of cases, the first consisting of twenty operations for uterine cancer in which no drainage was used; the second, 10 cases with both vaginal and abdominal drainage. In the first series of 30 cases streptococci were present in the parametrium in 5 cases, 4 of whom died of infection. Cultures were made from the carcinoma itself in 16 cases, none of which was sterile, with streptococci in 44 per cent. The author urges, therefore, careful preparation of the carcinomatous area prior to operation by means of curettage, cautery, iodine, and iodoform gauze. In the second series of 10 cases, streptococci were found in the parametrium four times, in two of which cocci were present in the glands themselves. Formerly the mortality from infection was about 20 per cent., whether the wound was closed without drainage or drains were inserted per vaginam or through the abdominal incision. Since employing both vaginal and abdominal drainage the mortality has dropped to 7.5 per cent. The author ascribes no importance to the bacteriological examination in arriving at a prognosis in any individual case, since this has been decided clinically before the examination can be completed.

The Occurrence and Complications of Sarcoma of the Ovary.—ALFRED WERMUTH (*Ztschr. für Geburt. und Gynäk.*, 1910, lxxvi, 123) states that, according to Pfannenstiel's statistics, sarcoma comprises 5 per cent. of ovarian tumors. Zangmeister states that puberty and the climacterium are the periods of predilection for their growth. In Pfannenstiel's series of cases, 40 per cent. occurred between the twenty-first and thirtieth years of life. The majority of sarcomas are solid tumors. Their size, consistency, and appearance vary, depending upon the variety of tumor presented, age, and secondary changes within the growth. According to their histological structure, they may be divided into spindle-, round-, or mixed-cell sarcoma; myosarcoma, chondro-osteo-sarcoma, myxo-

sarcoma, and melanosarcoma. Those of metastatic origin are, as a rule, bilateral, but seldom (in 29.6 per cent. of cases which the author collected from literature) are primary sarcomas bilateral. The spindle-cell variety grows slowly and shows but little tendency to metastasis, even when of considerable size. The round-cell variety exhibits a rapid growth and gives early metastasis. The clinical symptoms are those found in other ovarian tumors. In 60 to 70 per cent. ascites is present. Ovarian sarcoma in very young children is at times accompanied by development of the breasts, with growth of hair on the pubes, and the occurrence of genital bleeding. Various complications are frequent, especially adhesions to neighboring viscera.

OPHTHALMOLOGY.

UNDER THE CHARGE OF

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After-results of Magnet Attractions.—Based upon 18 cases reported before the American Ophthalmological Society, *Bull. (Ophth. Record)*, July, 1910, 372) concludes that when the wound of entrance is in the anterior segment of the eye, and the foreign body has been located in the vitreous or fundus, the attempt should not be made to extract through the entrance wound, but through an incision near the foreign body. If infection has already developed, the eye should be inoculated immediately, as should also be done if attempted extraction has failed. While the prognosis is unfavorable, it is better when the foreign body is lodged in the vitreous than when it is located in the retina, choroid, or ciliary body. As the danger of sympathetic inflammation is ever present, enucleation will be necessary in many cases when useful vision is lost even if the foreign body has been successfully extracted.

Scopolamin-Morphine Narcosis.—KUMMEL (*Klin. Monatsh. f. Augenh.*, April, 1910, 472) has experimented with scopolamin-morphine narcosis in ophthalmic surgery in 50 cases. An injection of 0.6 mg. in men and 0.5 mg. in women was administered two hours before operation. Morphine 0.01 gram was injected at the same time. If the first injection was inadequate, a second 0.3 to 0.6 gram was administered one hour later. The effect was usually satisfactory at the expiration of two hours from the first injection, and a third was rarely needed. Local anesthesia was also employed in most of the cases. Of the fifty cases so treated, the results were good in 46 per cent., satisfactory in 24 per cent.,

and failures in 30 per cent., but even in the latter the treatment was useful in that a much smaller quantity of the inhalation anesthetic was subsequently necessary than would have been required without such preparation.

Treatment of Sympathetic Ophthalmia by Large Doses by Sodium Salicylate or Aspirin.—GIFFORD (*Klin. Monatsk. f. Augenh.*, May-June, 1910, 588) insists that the surgeon who fails to give a patient suffering from sympathetic ophthalmia the benefit of large doses of sodium salicylate has not given him the best chance of recovering from his dangerous affection. Of 16 cases so treated by himself, he reports 12 excellent results, 1 satisfactory, 1 moderate, and 2 failures, in which latter, however, the treatment was begun too late in one case, and not well borne in the other.

Extraction in the Capsule.—Apropos of the Smith operation, NICATI (*Annal. d'oculist.*, June, 1910, 495) recalls a proposal by E. Martin more than twenty years ago for extracting the lens within the capsule, suggested by the instances occasionally observed of extrusion in the capsule through a rupture of the sclera by a cow's horn. The important factor in the operation is the use of a blunt point (in the Smith operation, the point of a strabismus hook) instead of the flat spatula or scoop. The spatula depresses the equator of the crystalline but slightly; with the blunt point much more extensive depression is possible, while the resisting equator of the lens is strongly carried backward so as to rupture the attachments with the hyaloid at the posterior pole. This is the essential part of the procedure.

Tuberculosis of the Lacrymal Sac.—PAGE (*Archiv. d'ophthalmol.*, June, 1910, 352) remarks upon the liability to mistake in recognizing tuberculous dacryocystitis when the latter is not secondary to manifest tuberculous lesions of neighboring structures, like the conjunctiva, or lids, lupus, or in the absence of visceral lesions of a tuberculous character. Morax has shown that tuberculous dacryocystitis is quite frequently an extension of concealed tuberculosis of the pituitary membrane, so that the nasal cavity should always be examined in suspected cases. Unilateral adenopathy of the neighboring glands is an important symptom when it occurs. Page distinguishes three forms: (1) That in which the deposit is round about but outside of the sac; (2) that in which there is localization within the sac; and (3) that in which sub-jacent osseous lesions are also present. As an important prophylaxis the nasal mucous membrane should always be systematically disinfected when lupus invasion of that membrane has occurred.

Etiology of Strabismus.—AUBINEAU (*Ann. d'ocul.*, February, 1910, 107) has made a study of 745 cases of strabismus—652 convergent and 93 divergent. Of the convergent, the refraction was hypermetropic in over 82 per cent. The vision in one eye was more or less amblyopic in all but 80 of the cases; one-fourth presented objective lesions, generally corneal. Of the cases of divergence, 75 per cent. were myopic, with unequal acuity in the two eyes in 56 per cent. Heredity and nervous affections were noted in a relatively high proportion.

Albuminuric Retinitis and Azotemia.—The importance of albuminuric retinitis and its serious nature have been long recognized, but the pathology of the lesion has remained obscure. Among the substances which may be retained in the organism during the course of nephritis, two have been the subject of special study in recent years—chloride of sodium and urea. WIDAL, MORAX, and WEILL (*Ann. d'ocul.*, May, 1910, 354) have observed 71 cases of nephritis of different types, of which 17 were affected with retinitis. There was no relation whatever between the retinal lesion and the retention of chlorides in any of these cases, while all of them showed more or less pronounced retention of urea.

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

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The Glycyl-Tryptophan Test for Carcinoma of the Stomach. The application to the diagnosis of cancer of the stomach of the fact that malignant tumors contain a peptid-splitting ferment, by NEUBAUER and FISCHER (*Deut. Arch. f. klin. Med.*, 1909, xcvii, 499) was reported in this Journal (1910, cxxxix, 284). They made use of a polypeptid, glycyltryptophan, the split product of which, tryptophan, is easily recognized by a color reaction with bromine. Trypsin regurgitated from the duodenum and blood will both accomplish this splitting and must be ruled out—by the tests for bile and for occult blood. The presence of tryptophan itself in the stomach must be excluded. The development of peptid-splitting bacteria is prevented by toluol.

LYLE and KOBER (*New York Med. Jour.*, 1910, xci, 1151) have applied the test in 21 cases of suspected carcinoma of the stomach. The test was positive in 10 cases, 6 of which have been proved carcinoma of the stomach by operation. Of the 11 negative cases, 5 have been confirmed by autopsy or subsequent course. The authors found the regurgitation of trypsin the greatest source of error. They do not believe the test for bile sufficiently sensitive for this determination. They have proved the presence of trypsin when the tests for bile were negative. So they advise giving the test meal in the afternoon after a purge the night before. They believe that no deductions should be drawn from less than three tests.

The Rapid Diagnosis of Diphtheria by Fixation of the Complement.—The present knowledge of the occasional unfortunate accidents accredited to anaphylaxis has made the indiscriminate employment of antidiph-

theric serum a dangerous one. A useless injection will develop this hypersensitiveness in a patient and expose him to the possibility of later accidents, as well as diminish the duration of the curative action of later serum therapy. The bacteriological diagnosis which has come to be relied upon necessitates a delay of eighteen hours. With this in mind, WEILLE-HALLE and BLOCK-MICHEL (*Bull. et mem. de la Soc. mèd. hôp. de Par.*, 1910, xxvii, 707) have made use of the method of Bordet and Gengou, of fixation of the complement, for a rapid, early, sure diagnosis. As antigen they employed an emulsion in salt solution of the mucus obtained from the tonsils and pharynx on a cotton tampon. Antidiphtheric serum from the Pasteur Institute contained the amboceptor, and fresh rabbit serum the complement. A sheep hemolytic system was employed. Twenty-five cases of diphtheria resulted in fixation; 10 cases of non-diphtheritic angina, 9 of measles, and 3 of scarlatina showed hemolysis and were negative.

The Bactericidal Substances Extracted from Normal Leukocytes. ZINSSER (*Jour. Med. Research*, 1910, xxii, 397) has investigated the properties of the bactericidal substances contained in normal leukocytes, especially in regard to their effect on *Staphylococcus pyogenes aureus* and *Bacillus typhosus*. The substances were obtained from leukocytes of rabbits by aqueous extraction and extraction in salt solution after freezing the leukocytes. The two methods gave extracts with practically the same bactericidal properties, which were tested by adding the extract to an equal part of a fairly constant bacterial emulsion. A fixed amount of this mixture was removed and plated in agar at various intervals. There was found a considerable uniformity in the action of the various lots of such extracts upon the same strains of the same organism, nor did various strains of the same organism show any marked variations in their susceptibility to the bactericidal substances contained in the extract. These substances are apparently distinct from and differently constituted to the bactericidal substances of their serum, not being destroyed by temperatures below 75° and after heating to 80° activation does not take place by the addition of fresh extract. There was no evidence that the leukocytic extracts contained complement, either for the activation of bactericidal antibodies in serum or for hemolytic amboceptors. Quantitatively these bactericidal substances are insignificant compared with the bactericidal powers of normal serum, and it is unlikely that they are responsible, except in a purely secondary way, for the curative results obtained in infections in animals and man. Leukocytes from immunized animals yield an extract with no stronger bactericidal properties than do those from normal animals, and it would seem that these substances, as contained in the leukocytes, may be at all times simply sufficient for the destruction of the limited numbers of bacteria which can be ingested by the cell, and have no quantitative relationship for the specific immunity acquired by animals or human beings during their reactions against spontaneous or experimental infection.

Autolysis of Pneumococci.—ROSENOW (*Jour. Amer. Med. Assoc.*, 1910, liv, 1943), makes a preliminary report of some very interesting and important results which have been obtained from his work on the

autolysis of pneumococci and the biological properties of substances separated by autolysis. True autolysis of pneumococci takes place when this organism is suspended in sodium chloride solution. It has been previously shown that the autolytic extract of highly virulent pneumococci in sodium chloride contained an antiopsonic substance. Further work indicates that by autolysis the toxic and non-toxic parts of the pneumococcus can be, to a large degree, separated. The part which goes into solution is the toxic portion and causes peritonitis and leukocytosis in animals, marked local reaction, leukocytosis and some fever when injected subcutaneously in man. Its repeated injection does not produce an immunity and when introduced intravenously into rabbits may prove fatal. The injection of the non-toxic and, as it appears, the antigenic portion on the other hand, causes practically no local reaction, only slight increase in the number of leukocytes, but a marked increase in the immunity curve as measured by the specific increase in pneumococco-opsonin. This non-toxic substance has been injected into twenty-five patients with lobar pneumonia and seemed to have caused material benefit. The author believes that by the injection of this substance the formation of antibodies can be stimulated at an earlier period than occurs naturally by the infecting pneumococcus.

The Cultivation of Tubercle Bacilli from Sputum.—There has always been much difficulty in cultivating the tubercle bacillus directly from the sputum, especially on account of the many secondary organisms. BROWN and SMITH (*Jour. Med. Research*, 1910, xxii, 517) have, however, by a simple procedure succeeded in obtaining pure cultures from the sputum in from nine to twenty days almost constantly in cases in which the organism was present. The secondary organisms were destroyed by treating the sputum with an equal part of 30 per cent. antiformin solution (equal parts of Javelle water and a 15 per cent. watery solution of sodium hydrate). After standing for one hour the sputum was centrifuged out and washed three times in distilled water, the sediment then being streaked on Dorset's egg medium. Blood serum and glycerin-agar gave negative results as far as tested for growing the bacillus after the antiformin treatment of the sputum. Fifty specimens of sputum were studied. Of these, 35 showed microscopically tubercle bacilli, while 15 were negative. Positive cultures were obtained at the first attempt in 33, or 97 per cent. of the 35 cases showing tubercle bacilli, while the cultures were positive in 4, or 27 per cent., of the cases negative microscopically for tubercle bacilli. As the cultures were positive, as a rule, in from nine to twenty days, the authors suggest that the method may prove especially valuable as a means of obtaining an homologous vaccine for any patient in a comparatively short time.

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ORIGINAL ARTICLES.

DILATATION OF THE AORTA.¹

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INTRODUCTION. As regards the subject of this paper, there is some difficulty in terminology, as the term dilatation of the aorta is variously applied. In this connection it is used to describe the condition in which the aorta is enlarged in its whole circumference, the extent of this varying, sometimes being of the whole arch, sometimes extending to the point where the aorta passes through the diaphragm, and sometimes involving the whole course of the aorta. Is it proper to consider such a condition as an aneurysm? This will depend on the meaning we attach to the term. If we use it in the widest sense as being properly applied to any increase in the size of an artery, this diffuse dilatation would be included. On the contrary, if the term aneurysm be restricted to a tumor containing blood in direct communication with the cavity of the heart or the lumen of an artery, the diffuse dilatation is excluded. The fusiform or globular dilatations of the aorta were designated "true" aneurysms by the older writers. Thoma described them under the designation of *aneurysma verum diffusum*, and Walshe as peripheric dilating aneurysms. The terms true and false as applied to aneurysms have been used in a confusing way, having been employed in exactly opposite significations. Scarpa used the term "true" to

¹ Read at a meeting of the Association of American Physicians, Washington, D. C., May 3 and 4, 1910.

designate aneurysms in which all the coats were not present, and "false" to describe those in which all the coats remained and no coagulation had occurred, but the terms were subsequently applied in exactly an opposite sense. It is evident that such distinctions are of no definite value, and the terms false and true are better dropped from the terminology.

In this article the term dilatation is employed to designate a condition which, strictly speaking, probably comes under the term aneurysm as we generally use it, but there is no question that in its clinical aspect it differs considerably both from the saccular and ordinary fusiform aneurysm of the aorta. As Gairdner pointed out, in these cases of diffuse dilatation of the aorta there is nothing that, "clinically speaking, can be definitely called a tumor."

It is surprising how little attention has been given to diffuse dilatation of the aorta, although it has long been recognized. In some text books it is referred to under the headings of chronic aortitis and aneurysm. Morgagni distinguished between the enlargement which involved the whole circumference of the aorta and that which rose from one part, while Searpa did not regard the enlargement of the whole aorta as aneurysm. Vieussens and Boerhaave also recognized the condition, but it is not always easy to make out whether they are describing a large fusiform aneurysm or the diffuse dilatation.

The first accurate description was given by Joseph Hodgson² in 1815, who distinguished the condition from ordinary aneurysm and referred to it as a "preternatural permanent enlargement of the cavity of an artery." By many French writers the condition is termed *maladie de Hodgson*, although some regard an associated aortic insufficiency as an essential part of the picture. Thoma,³ in 1888, wrote extensively of this form, and gave one of the best descriptions of it. As Osler points out, it is a striking commentary on the difficulty of recognition that, of the cases studied by Thoma,³ very few had been recognized clinically. It is one of the conditions which has heretofore been more often found in the dead house than recognized in the wards. This is due to various reasons: the condition itself may not give any symptoms, and its signs are overlooked; or signs suggesting some other disease, especially angina pectoris, may cause error; or the signs of associated cardiac disease may dominate the picture.

For this study a series of sixty cases is considered, all of which occurred in the wards of the Johns Hopkins Hospital or were seen in consultation.

ETIOLOGY. There are probably two main groups, one in which the dilatation occurs with an acute infectious disease, notably

² Diseases of Arteries and Veins, London, 1815.

³ Virchow's Archiv, 1888, cxi, 76; 1888, cxii, 259, 383; 1888, cxiii, 244, 505.

rheumatic fever, and the second in which the factors are essentially those which cause arteriosclerosis and aneurysm. In the latter group the essential factor appears to be disease of the vessel wall, with loss of elasticity and subsequent dilatation, probably largely in the nature of a mechanical process. The various factors in this series are as follows:

1. *Age.* Eleven to twenty years, 1; twenty-one to thirty years, 1; thirty-one to forty years, 16; forty-one to fifty years, 16; fifty-one to sixty years, 16; sixty-one to seventy years, 8; seventy-one to eighty years, 2.

Of the 18 patients under the age of forty years, 15 were males (9 white and 6 colored) and 3 females (1 white and 2 colored). The relative preponderance of colored patients among the younger ones is a striking commentary on their tendency to early vascular degeneration. The majority of these 18 patients gave a history of severe muscular exertion for many years; there was a definite history of syphilis in 6 of them, and 7 had aortic insufficiency, while in 5 of the last 10 cases there was a history of heavy drinking. It will be noted that the number is the same in the fourth, fifth, and sixth decades. In regard to the small number in later periods it must be kept in mind that these figures come from a general hospital, and that those with diffuse dilatation in later life rarely have any symptoms from it. It occurs not uncommonly without any symptoms in the aged in almshouses and asylums, and is only recognized at autopsy.

2. *Sex.* The condition occurs most often in males, as might be expected. In this series there were 54 males and 6 females, 4 of the latter being colored.

3. *Color.* The colored race shows a relatively high proportion; of this series, 39 were white and 21 colored (the total medical admissions being about 5 to 1). This is in agreement with the relatively high incidence of aneurysm and sclerotic vascular disease among them, due probably to alcohol, syphilis, and hard work. The total medical patients with aneurysm numbered 399 (white 239, colored 160), so that the relative proportions for aneurysm and dilatation of the aorta are about the same.

4. *Syphilis.* This stands out as an important cause, but probably not so markedly as in aneurysm. There are two principal forms of dilatation influenced by syphilis, one in which the process occurs with an acute syphilitic aortitis, usually seen in young adults, and the other in which the condition results from general chronic changes in the vessel wall. In this series there was a definite history of syphilis in 17 cases and probable in 8 cases. The Wassermann reaction was tried in 8 cases, with a positive result in only 3 cases. This is in such striking contrast to the results in aneurysm that it suggests that syphilis does not play such an important etiological part in dilatation.

5. *Work and Muscular Exertion.* These are factors in dilatation exactly as they are in the production of general arteriosclerosis. Occupations which involve very severe exertion at irregular times, such as that of stevedore, will evidently favor the condition. A sudden increase in the blood pressure must have more influence on the aorta than on any other vessel. In this series 39 of the patients had done hard muscular work, 7 were engaged in business, and 7 did housework. The others had light occupations. Among those who had done hard work, in a large proportion this had involved severe sudden irregular exertion. This is very striking in going over the histories, and an unusual proportion of the men had occupations which involved the lifting of heavy weights.

6. *Alcohol.* How much this is a factor, it is difficult to say. In this series 25 had used alcohol to excess, and 22 were described as moderate users, which is certainly a high proportion.

7. *Acute Specific Infections.* These probably play a more important part than is generally considered, for when we remember how much damage may be done to the aorta in the course of an attack of typhoid fever, it seems probable to suppose that later changes may gradually develop, especially if other factors are added. Whether or not there is a true primary aortitis apart from syphilis is difficult to say, but it seems probable to suppose that it may occur. There is one infection in which dilatation may occur during the acute attack. This is rheumatic fever, in which there may be an acute dilatation of the aorta, usually with aortic endocarditis. There was a definite history of this disease in 13 cases, and in 6 others of an attack of acute arthritis the nature of which was doubtful. A striking feature was the large proportion of the younger patients who gave a history of rheumatic fever, for of the 18 patients under the age of forty years, 9 had suffered from rheumatic fever, several with repeated attacks, which seems a high percentage. As the majority of these had aortic insufficiency, it is a reasonable supposition that acute aortitis occurred, which was followed by chronic changes. Even in young children dilatation of the aorta may occur with aortic endocarditis in rheumatic fever, and it seems reasonable to suppose that this is permanent in some cases. There was a history of typhoid fever in 8 cases, 3 of these being below the age of forty years. In one case, a man aged thirty-three years, the symptoms began during recovery from an attack of typhoid fever, but he had several attacks of rheumatic fever previously. The same condition may occur with acute sepsis. Some writers have suggested that there might be an extension of inflammation from an endocarditis, pericarditis, or pleuritis. It seems reasonable to suppose that if recovery followed an attack of acute aortitis, a chronic condition with tendency to dilatation would be left.

8. *Old Age.* This is only a cause in so far as the passage of years brings sclerotic changes. It is probably then only to be regarded as one of the natural changes.

9. *Malaria*. There are few conditions for which malaria is not given by some one as a causal factor. There does not seem to be any evidence to suggest any association with dilatation of the aorta, but it is constantly repeated by various authors.

10. *Severe Strain or Exposure*. The importance of a factor such as this is difficult to estimate, and any effect is probably only in causing symptoms to appear from a condition already present. There is one striking example in this series:

The patient, a white male, aged thirty-seven years, a ship captain, came complaining of shortness of breath. He had not had typhoid fever, rheumatic fever, or pneumonia. Although he had followed the sea most of his life, there was no history of syphilis, and he had used alcohol very moderately. His illness began one month before, previous to which he had been perfectly strong and well. His ship caught fire, and they had to take to the boats. Naturally he was under a heavy mental strain, and in addition was exposed to bad weather before they were picked up, as a result of which he had a severe attack of bronchitis, with which there was shortness of breath, which continued. He had a well-marked dilatation of the aortic arch, seen with the fluoroscope, with dulness over the manubrium and in both the right and left first and second interspaces, where there was a faint visible pulsation. The heart was not enlarged; the sounds were clear, the second being very ringing. The pulse rate was normal, and there was moderate thickening of the peripheral vessels. His symptoms gradually cleared, and he has been well for some years.

11. *Trauma*. The influence of this is most probably shown in determining the onset of symptoms. In one patient, a miner, aged thirty-nine years, the onset of symptoms followed an injury sustained by being struck on the chest by a dump cart in a mine. He was knocked unconscious and remained so for twenty minutes. On recovering consciousness he had dyspnoea and severe pain in the chest, which became less after three weeks, but the dyspnoea continued. He was found to have aortic insufficiency, which was thought to have been due to rupture of an aortic cusp. He had been previously a very hard worker in a steel plant, where he carried heavy weights, had drunk heavily, and probably had syphilis, so that there were causal factors other than the trauma.

MORBID ANATOMY. The lesions include those of chronic aortitis and secondly the dilatation. This is of varying extent, and may involve only a portion of the thoracic aorta or extend throughout the whole course of the thoracic and abdominal aorta. In the cases of this series coming to autopsy the process did not extend beyond the point where the aorta passes through the diaphragm. The dilatation may end here very abruptly; thus, in one case the aorta measured 8 cm. in circumference at the lower part of the dilatation, and only 4.5 cm. below. The form of the dilatation is

various, and may be spindle, spheroid, or pyriform in shape, or sometimes like a flabby bag. The orifices and part of the vessels given off from the aorta may be involved in the dilatation.

Associated conditions may have a marked effect on the symptoms. Thus, if the chronic sclerotic process has involved the aortic ring, there is likely to be aortic insufficiency in consequence of the valvular changes. If the first part of the aorta is specially involved there may be coronary artery disease. If the orifice of the left subclavian is narrowed the pulse in that arm may be small. One result is of special interest, namely, relative aortic insufficiency due to dilatation of the aortic ring. There were two such cases in this series. In one case a loud aortic diastolic murmur was heard for some time, which disappeared before death, and at autopsy the aortic valves were normal and apparently closed the orifice completely. Probably the decrease in blood pressure, for some days before death, allowed the dilatation of the aorta to diminish and the aortic ring returned to its usual size.

Thrombus formation in the dilated aorta is not common. Osler⁴ mentions a specimen in the Museum of McGill University in which the descending thoracic and abdominal aorta was dilated and the abdominal aorta filled by a densely laminated thrombus. Although in the majority of cases the aorta shows marked gross evidences of disease, yet this is not always the case, and the intima may be smooth and apparently normal.

The association of sacculated aneurysm with dilatation of the aorta is mentioned, but no instance was found in the cases of this series which came to autopsy. In one case with general dilatation of the aortic arch there was an aneurysm of the left axillary artery. Thoma figures an instance in which a secondary aneurysm arose through a rupture of the wall of the dilated aorta.

SYMPTOMS. Dilatation of the aorta rarely exists alone, and hence it is difficult to decide which symptoms are due to it and which to associated conditions. When present alone, especially in old people, it may not cause any symptoms, as is proved by the discoveries of the autopsy room. Symptoms due to valvular disease, especially aortic insufficiency, myocarditis, coronary artery disease, and angina pectoris, may be present. The effort to eliminate these as far as possible is made in this study, and it is important to try to decide to what extent we have a definite clinical picture due to dilatation. I believe that in many instances the picture is characteristic, and that the diagnosis can be made with reasonable certainty even before it is confirmed by a fluoroscopic examination. The history of a typical case brings out the general features.

The patient was a male, aged fifty-six years, a merchant by occupation. He came complaining of occasional uneasy feelings

⁴ Modern Medicine, iv, 463.

in the thorax, which he described as being rather more than oppression and yet less than severe pain. He was rather apologetic about consulting a physician, as he feared he might be thought to be making too much of a little thing. The family history was negative. In his previous history it was found that the patient had had diphtheria, measles, and typhoid fever. He had not been a specially heavy eater, but had always used alcohol rather freely. For some years he had been working at high pressure, carrying a great deal of responsibility and a heavy load of worry. There was no history of lues.

For about two years he had noted at times, especially with any sudden exertion, such as running for a car, or any unusual excitement, that he had a curious feeling in the chest. This was generally described as being in the sternum or a little to the left of it, although at times it was apparently more marked at the lower end of the sternum, and occasionally it radiated into both shoulders. None of these attacks were at all alarming, and he was always able to go on, although sometimes he had to rest a few minutes before doing so. No one had ever commented on anything strange in his appearance when they occurred. He himself thought it was needless to seek advice, but the continuance of the symptoms rather worried him.

The patient was the picture of robust health; he was well nourished and had a good color. The lungs were clear throughout. The visible cardiac impulse was not marked; the maximum impulse was in the fifth interspace inside the nipple line; the area of dulness was not increased, and except for a soft systolic murmur in the pulmonic area, the sounds were clear. The pulse was 72, of good volume and regular; the blood pressure was 135 mm. On inspection, there was a distinct lift of the manubrium and a visible pulsation in the first and second right and left interspaces. On percussion, there was dulness over the manubrium and to either side. On auscultation, both sounds were heard at the base, the second with a marked ringing, amphoric quality, which could be made out over a rather wide area. The fluoroscopic examination showed a diffuse enlargement of the whole aortic arch, and a shadow could be seen both to the right and left of the sternum, continuous with that of the heart. This patient has been under observation for nearly four years and no material change has occurred, except that the "attacks" have decreased and are now infrequent.

Clinically there are several groups of cases, which usually can be separated without much difficulty:

1. *Latent Cases.* Absence of all symptoms is especially likely to occur in old people, and the condition is often found unexpectedly post-mortem. In this series there were nine patients in whom the condition was recognized only by the routine examination, as they made no complaint of any symptoms which suggested disease of the cardiovascular system. One was admitted for diabetes, one for chronic alcoholism, one for organic disease of the spinal cord, one

for lipoma, one for diarrhœa, and the others for indefinite complaints. In all the diagnosis was confirmed by the fluoroscopic examination.

2. A group in which *cardiac symptoms*, suggesting failure of the heart muscle, predominate. In the cases with marked signs of valvular lesions, aortic insufficiency predominates. The picture is often that of cardiac failure, which is the final stage in the majority of cases, not because of the dilated aorta, but on account of the associated conditions.

3. A group with features much like those of *angina pectoris*; in fact, sometimes it may be difficult to say that angina is not present. There were fifteen patients in this series in whom the pain might be described as anginoid, and others gave a history of it. In all of those who had the attacks of thoracic pain while under observation it was noted that the severity was less than that usually seen in *angina pectoris*.

4. A group in which the symptoms are those of the condition in the aorta itself, the heart being practically normal. These patients often give a history of symptoms which suggests cardiac disease.

Complaint. This usually suggests some circulatory disturbance. The most frequent is shortness of breath and dyspnoea, usually not constant unless there is a marked cardiac condition present. Next in frequency is the complaint of thoracic pain of varying degree. Œdema of the feet and legs, which in several occurred without the heart showing any signs of disease, is fairly common. Weakness is rather a frequent complaint, and loss of weight, cough, palpitation of the heart, syncopal attacks, giddy feelings, hoarseness, thumping in the chest and neck, change in the voice, and indefinite pains were also mentioned by some patients. Only one patient complained of difficulty in swallowing; this was verified by observation and occurred quite frequently. That certain patients had no symptoms referred to the vascular system has to be remembered in regard to the figures.

Onset. This was gradual in 41 and sudden in 10 (9 had no symptoms); in 3 of the latter it followed unusual exertion, in 1 injury, in 1 severe mental strain and exposure, in 1 the change to a high altitude, and in the others there was no definite cause.

Dyspnoea was the most common symptom, and occurred in 42 cases. Its severity depended largely on the state of the heart, and when this was normal it was usually brought on by special exertion or excitement. Cough accompanied it in 16 cases, in 3 with spitting of blood. A striking point in several cases was that the dyspnoea was quite out of proportion to anything that could be found to account for it.

Œdema of the feet and legs occurred in 16 cases. In several of these the heart seemed normal in every way, and, as a rule, the blood pressure was low.

Pain was a prominent feature in 20 cases. In 6 of these it was referred to the chest generally without any special localization; in 4

it was referred to the left chest; in 9 it was referred to the heart, and in 5 of these it radiated to the shoulder and arm (3 to the right, 1 to the left, and 1 to both arms); and in 1 it was on the right side of the sternum. The attacks of pain were usually not very severe, but sometimes continued off and on for some hours, and generally were not accompanied by any change in the patient's appearance. In only one case was there any note of sweating with the attack of pain. Walking against a strong wind, sudden exertion, excitement, and overloading of the stomach were all given as causal factors, by which angina pectoris is suggested.

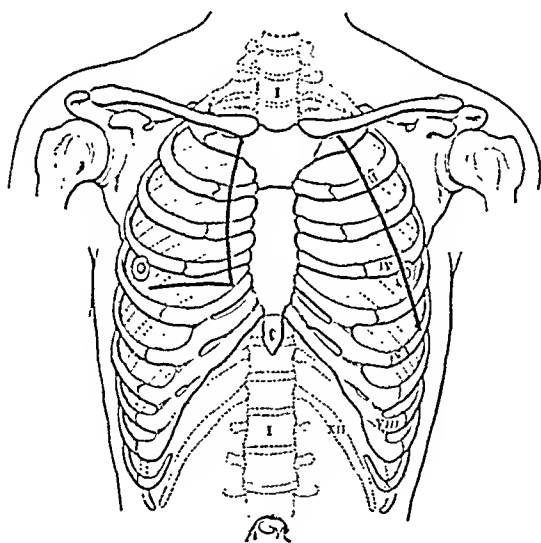
PHYSICAL SIGNS. With the frequent association of various cardiac conditions it is natural to have signs due to them, but these require no discussion and only features of dilatation are considered. A striking condition is marked fulness of the veins, especially those of the neck, upper thorax, and arms, the first named usually being the most dilated. The visible arterial pulsation is sometimes very diffuse, and often very marked over the carotids and subclavians. In several cases it was much more marked over the right than over the left carotid. The subclavians seem to be lifted higher than normal by the dilatation of the aorta and may be seen above the clavicles. There may be a visible swelling, as in two patients in whom a pulsating mass the size of a hen's egg was visible at the inner end of the right clavicle and in the episternal notch. With the enlargement of the aorta it would be expected that pulsation in the episternal notch would be frequently seen, and such is the case, as in 22 cases it was well marked.

A most important point on inspection is pulsation in the first and second interspaces. This is usually best seen with the patient lying down and the examiner with his eyes about on a level with the thorax; good light is essential, and the inspection should be from various positions in regard to the patient. An impulse may be seen in one interspace only or in any combination of the first and second right and left interspaces. The second right is the most frequent situation, then the second left, first right, and first left interspace. This visible pulsation, as a rule, is more diffuse and not so localized as in saccular aneurysm. In some cases it is more evident when the patient is sitting than when lying. It can rarely be felt distinctly, and does not give the feeling of being more forcible than the cardiac impulse; in fact, the pulsation in dilatation is usually more evident on inspection than on palpation. It does not lift the palpating finger, as may occur in aneurysm. There was a definite lift to the manubrium in 26 cases; this was usually better seen than felt. In 5 the absence of any visible heaving was noted, and in the remainder the point was not noted. In two cases the manubrium was prominent and there was a distinct lift of it and the inner end of both clavicles; in one, of the manubrium and right clavicle. In one the inner end of

the right clavicle was lifted. In some cases it was noted that there was a widespread visible heaving, but no well-marked local impulse.

Pulsation in the back in the left interseapular space was observed in one case only. In this case it disappeared after a period of rest, which usually results in a diminution in the extent of the visible pulsation in front.

Palpation. In a number of cases the aorta can be palpated in the episternal notch and the subclavian arteries above the clavicles. In one case there was a distinct pulsating tumor projecting above the inner half of the right clavicle and in the episternal notch; the finger could be passed between it and the clavicle. The heaving of the manubrium could be felt in 6 cases. The contrast between the marked *visible* lift of the manubrium and the slight *palpable* lift is often very marked. The shock of the second sound was felt at the base in 9 cases. A diastolic thrill was felt over the manubrium in 4 cases, and only in the aortic area in 4. In 1 case there was a marked diastolic thrill over the right sternoclavicular joint, the manubrium, and the upper half of the sternum.



The area of dulness in dilatation of the arch of the aorta.

Percussion. The results of percussion are perhaps the most important in the recognition of dilatation, and the finding of dulness over the manubrium in a routine examination may suggest the diagnosis. In 55 cases of the 60 there was distinct dulness over the manubrium. In 2 cases its absence was noted, 1 being with marked emphysema, and in 3 cases there is no note. The area of dulness was usually continuous with the cardiac dulness, and generally extended some distance outside the edge of the sternum, as a rule, both in the first and second interspaces. In 28 cases it was marked in the first and second right and left, in 7 in the first right and left, in 2 in the

first left, and in 2 each in the first and second right and first and second left interspaces. The width of the area of dulness varies somewhat, the usual transverse measurement being about 7 or 8 cm. The widest was 14 cm. in the first interspace, and there were several with an area of dulness measuring 10 cm. across. As a rule, the dulness is more marked to the left of the sternum than to the right. The usual area of dulness is shown in the accompanying diagram. Changes in some extent of the area of dulness occurred in several cases, some increasing and some decreasing. In some patients who have been followed for years a definite increase in the extent of dulness has been noted. In one patient, who was bled 500 c.c. with marked benefit to symptoms due to cardiac failure, no decrease in the area of aortic dulness was made out. The occurrence of an area of dulness, as described by Potain, extending from the manubrium in a segment of a circle to the right, with a shape like the "crest of a fireman's helmet," has not been made out.

Auscultation. When the second sound is present it often has a distinct quality at the base which is the most characteristic sign on auscultation, and in several instances first suggested the diagnosis. This is a bell-like, ringing, amphoric quality, very distinctive when once heard, and quite different from the accentuation found with high blood pressure. It has been given various descriptions, "clang-oreux" by de Mussy, "bruit de tabourka" by Potain, "timbre métallique," etc. This sound may be heard over a wide area and with especial distinctness over the manubrium and in the neck over the carotids. It was well-marked in 12 of 22 cases in which the second sound was clear. In 5 cases with aortic insufficiency the second sound had this quality, and the diastolic murmur had somewhat the same. In 2 cases of aortic insufficiency in which the second sound had entirely disappeared, the diastolic murmur had this amphoric, musical quality. When aortic insufficiency is present the diastolic murmur may be heard with great distinctness over the manubrium and at the episternal notch.

Pulse. In the cases with no decided cardiac change there was no striking peculiarity. The rate was not particularly rapid; in about one-third of the cases it did not rise above 80, and in the same number was not above 100 as a rule. In 4 cases the rate was persistently below 70, in 1 being usually about 50 per minute.

Blood Pressure. It might be expected that this would be high and such a statement is made in the literature, but the results of this series show the contrary. Of course, in a condition which is so likely to be associated with other vascular lesions, there are many factors which influence the blood pressure. However, in the cases in which the aortic dilatation was the prominent factor the blood pressure was low. This may seem surprising when we consider the common sclerotic changes, but the alteration in the aorta must have considerable effect. The large vessels by their elasticity tend to convert

the intermittent force of the heart into a continuous pressure. But when the aorta is dilated and has lost its elasticity, the blood is forced into a more or less rigid reservoir and a low pressure is the result. Among 48 cases with records, in 35 the average systolic pressure was below 140 mm. (Riva-Rocci instrument, broad arm-piece). In 3 of these it rose temporarily to higher figures. In 3 patients it varied from 70 to 95, never being above the latter figure, and with an average of 80. One of these had acute endocarditis on an old chronic process, with which he died. The other had quite marked arteriosclerosis with aortic insufficiency, and was discharged from the hospital in fairly good condition. Of the remaining cases, 9 varied from 125 to 180, and the others from 150 to 260. In the majority of these the higher figures were only for short periods, the pressure falling rapidly, in one case from 200 to 130, where it remained. Practically all the patients with the higher figures had cardiac hypertrophy; in the patients without marked changes in the heart the pressure was usually between 120 and 135. Crises of hypertension described by some writers were not observed in this series. Several patients with chronic nephritis (urine of low specific gravity, containing a very slight amount of albumin and a few casts), had a low blood pressure.

In 9 cases in which there were records of both the systolic and diastolic pressure, these showed a fairly steady difference of about 30 mm. Hg. This was practically the same whether the pressure was high or low.

Fluoroscopic Examination. This is a most important part of the examination, and in doubtful cases is usually the deciding point. Dr. Baetjer, who has had a large experience in thoracic fluoroscopic examinations, gives the following description: "Dilatation of the aorta is marked by an increased width of the aorta. In normal conditions fluoroscopic examination reveals only the bend of the aorta projecting to the left of the sternum and just beneath the clavicle, the ascending and descending portions being invisible behind the sternum. In dilatation there is a shadow projecting to the left of the sternum and extending downward to be lost in the shadow of the heart. This shadow may vary in size and in extreme dilatation may project to the right of the sternum. This shadow persists between pulsations, showing that there is a true dilatation of the aorta. In neurotic individuals and when the blood pressure is low we frequently find the aorta, in pulsation, extending beyond the sternum, but between pulsations it invariably recedes behind the sternum and is lost to view." The degree of visible pulsation varies, but in the majority there is no great difference in the extent of the shadow during systole and diastole. In one patient with quite marked dilatation it was noted by Dr. Baetjer that the shadow to the left of the sternum did not vary, but that to the right did. This may have been due to the greater direct force of the flow

from the ventricle on the first portion of the arch. In several instances it was noted that the shadow of the aorta extended unusually high in the thorax. Dr. Baetjer tells me that in several patients the position of the heart in the thorax seemed more horizontal than normal.

Pressure Effects. These are interesting in view of their frequency and importance in the symptomatology of saccular aneurysm of the aorta. In diffuse dilatation they are less frequent and less serious.

(a) *Vascular System.* Fulness of the veins of the neck, upper thorax, or arms occurred in about one-third of the cases. In 6 cases the radial pulses were unequal, in 4 the left being the larger and in 2 the right. The blood pressure was unequal in the brachials in 3 cases, in 2 that in the left brachial being the higher. The difference varied from 13 to 18 mm. Hg. In one case the vessel with the larger volume had the lower blood pressure. The difference in the radial pulses may be due to some obstruction at the beginning of the innominate or subclavian artery, or the innominate or subclavian artery may be involved in the dilatation.

(b) *Respiratory Tract.* A tracheal tug was noted in 12 instances, in 4 of which it was quite marked for some time after admission, but with improvement in the general condition it disappeared. In one patient the tracheal tug was present on several occasions on admission, but disappeared under rest, and coincident with this it was noted that the area of aortic dulness had decreased. In some patients there was dulness at one or both bases, but this may have been due to the state of the heart. In 3 patients there was recurring hydrothorax on the right side, for which repeated tapping had to be done.

(c) *Nervous System.* There was inequality of the pupils in 9 patients. In 3 the left was the smaller, in 5 the right, and in 1 there was no note. The usual opinion has been that this was due to pressure on the sympathetic, but alterations in the circulation may be more important. There was pressure paralysis of the left vocal cord in 3 patients, and in 5 others the voice was hoarse and the cough had the "goose" quality. One patient has been under observation since 1905, at which time he had complete recurrent laryngeal paralysis of the left vocal cord, which has continued to the present. The first symptoms were two years before his first admission, when he had pain in the upper thorax, with suffocating feelings and a marked change in the voice.

In some cases the pain or numbness felt in the shoulders and arms was persistent. One patient had constant pain in the left shoulder, which occasionally radiated down the arm and to the scapula. In one patient pressure over the fifth, sixth, and seventh dorsal spines caused severe pain. The same patient had pain in the heart and left shoulder on firm pressure over the precordium.

(d) *Bones and Muscles.* There was no instance of perforation of the thoracic wall or erosion of the vertebræ.

(e) *Alimentary Tract.* Dysphagia was present in one patient. No attempt was made to prove the presence of obstruction.

It is rather surprising, perhaps, to find the pressure signs occurring as often as they do, although, of course, with less frequency than in aneurysm. They that should occur is not surprising in view of the anatomical conditions. In a previous paper on this subject⁵ the view was taken that the pressure effects were comparatively few, but the study of subsequent cases has rather modified this view. Still the pressure effects are rarely serious.

ASSOCIATED CONDITIONS. Thickening of the palpable arteries was found in the great majority of the patients, and in 39 cases it was noted as being marked. In 5 there was calcification of the vessels. Aortic insufficiency was present in 27 cases, in 18 with mitral insufficiency, in 3 with aortic stenosis and mitral insufficiency. Mitral insufficiency without an aortic lesion was found in 4 cases, all having marked arteriosclerosis. The heart was practically normal, so far as could be made out, in 18 cases; in 5 others there was marked hypertrophy, and in 4 others slight hypertrophy without any valvular lesion.

RELATIVE AORTIC INSUFFICIENCY. This is rare under any circumstances, but dilatation of the arch of the aorta should favor its production. There were 2 cases in this series in which the signs suggested this condition.

The first patient was a colored female, aged thirty-two years, admitted March 25, 1898, with dyspnoea and œdema. She had marked fulness of the veins of the neck and upper thorax. The heart was enlarged to the left and there was a heaving impulse over the manubrium, with dulness, which extended into the first interspace on both sides. There was a well-marked systolic murmur at the apex and a definite diastolic murmur in the aortic area. The second sound could be well heard over the manubrium and in the neck. Later there was a diastolic shock at the base. The pulse varied from 70 to 80; it was not specially collapsing, and the pulse tracing did not suggest aortic insufficiency. The presence of the aortic diastolic murmur was noted by Dr. Osler. The fluoroscope showed dilatation of the arch. She was admitted six months later with marked dyspnoea and œdema. There was marked pulsation in the episternal notch, but the heaving of the manubrium was not as marked as on the previous admission. Over the body of the heart the second sound was much accentuated, but no diastolic murmur could be heard. She died the day after admission. The autopsy showed arteriosclerosis, hypertrophy of the heart, pulmonary thrombosis, and dilatation of the arch of the aorta, with uncon-

compensated degeneration in the intima and media. The aortic and mitral valves were normal. The aorta was much dilated and thin, measuring 9 cm. in diameter above the valves. It showed many areas of nodular thickening, and three areas about 1.5 cm. in diameter, which were very thin.

The second case was a man, aged sixty-four, who was admitted with dyspnoea and swelling of the feet. The heart was much enlarged, with a soft systolic murmur at the apex and a definite diastolic murmur in the aortic area. The second aortic sound had a ringing anphoric quality. Within a week the diastolic murmur had disappeared, to reappear later. Four months later he was admitted again with a curious continuous murmur best heard at the aortic area. At times it had a systolic intensification, but was very variable and markedly altered by changes in the patient's position. The diastolic murmur was not heard on later examinations.

The infrequency of relative aortic insufficiency is well recognized, and the experience of this series does not support the view expressed by Balfour,⁶ that "when once dilatation of the ascending aorta is produced, the secondary development of incompetence of the aortic valves is only a question of time." Some of these patients have been under observation for years and an aortic murmur has never been heard.

Renal System. This showed changes in the majority of cases. A number had chronic nephritis; others had albumin and casts or albumin alone.

Blood. This showed no changes of any moment. The count was about normal in the majority, a few showing secondary anemia.

Intestinal Hemorrhage. One patient, a colored man, aged thirty-three years, had several large hemorrhages from the bowel, for which no cause was found. This is interesting in connection with the observation made by Albers, of Bremen, and quoted by Dr. Osler,⁷ in which hemorrhage of the bowels occurred with dynamic dilatation of the aorta.

Course. In so far as dilatation of the aorta is concerned, apart from other cardiovascular lesions, there seems no reason why it should not continue indefinitely. It is the associated conditions which are of moment in the prognosis. One patient in whom the condition was recognized in a routine examination has gone for five years without any evident change, and without any symptoms which might be referred to the condition of the aorta. Serious accidents, such as occur in saccular aneurysm, were not noted in this series. There was no instance of rupture of the aorta, although it seems possible that this might occur, or of dangerous pressure

⁶ Clinical Lectures on the Diseases of the Heart and Aorta, London, 1882.

⁷ A System of Medicine, Allbutt and Rolleston 1909, vi, 669.

signs. The mode of life must have considerable effect on the outlook, and patients who can live a quiet regular life may go on indefinitely. Unfortunately in many of the patients the occupation is an important factor in the etiology, and they are often unable to obtain easier work. Occupations involving sudden severe exertion have a very detrimental effect. In the majority of cases it is probable that the condition of the first inch of the aorta will largely determine the outlook. With serious disease of the aortic orifice or interference with the coronary circulation, the prognosis is grave.

DIAGNOSIS. It is important to recognize the frequency of the condition and to be on the watch for it. The complaints usually suggest disease of some other organ, and the physical signs may not attract attention—they have to be looked for. There are two groups of cases in which the diagnosis may be suggested. In one the history and symptoms suggest cardiac disease, but on examination no disease of the heart is found. In the other group the history of thoracic pain may suggest angina pectoris, but careful scrutiny does not bear out this diagnosis. In many cases the dilatation of the aorta is accompanied by cardiac disease, and it is easy to rest satisfied with the recognition of the most obvious process. Of the physical signs, the visible impulse seen over the manubrium and in the adjoining first and second right interspaces, the area of dulness, the curious amphoric quality of the second sound, if this be present, and the fluoroscopic examination give the greatest aid.

Various other intrathoracic conditions have to be considered, the tendency being rather to regard dilatation as being one of these than the contrary.

1. *Saccular Aneurysm of the Aorta.* The view may be taken that there is no need to attempt to distinguish between saccular aneurysm and diffuse dilatation of the aorta. This, however, is not correct, because the treatment is entirely different. To attempt to wire a diffuse dilatation of the aorta could not possibly be of any advantage and would do harm; while as regards a prolonged period of rest, it is doubtful if this is indicated in diffuse dilatation. The outlook is also quite different, being much less favorable in saccular aneurysm. The points in the differential diagnosis are as follows:

(a) *Pulsation.* As a rule, the visible pulsation is more diffuse and widespread in dilatation, and an important point is the difference on palpation. The impulse in the interspaces in dilatation may be readily visible, but cannot be felt, while in the sacculated aneurysm it is more punctate and readily palpable. Very often the pulsation of a saccular aneurysm is more forcible than that of the heart. The heaving impulse of the manubrium is not readily felt in diffuse dilatation and the impulse in the interspaces may not be palpable.

(b) *Percussion.* The area of dulness in dilatation is more or less regular. It is found over the manubrium and perhaps on both sides of it, usually rather more to the left. As a rule, it is continuous with

the cardiac dulness, whereas in saccular aneurysm very often an area of resonance is found between the cardiac dulness and that of the aneurysm. In only one instance of this series was dulness made out in the interscapular region and this was only temporary, disappearing under rest.

(c) *Auscultation.* The curious quality of the second aortic sound, already referred to, is very significant when present. The wide area over which the second sound and the murmur of aortic insufficiency, if present, is heard, may be an important point.

(d) *X-ray Examination.* This gives information of the greatest value, and in a doubtful case must be the deciding test. Naturally its value depends on the experience of the observer. The possibility of atypical pictures due to some unusual position of the aorta must be kept in mind.

(e) *Pressure Effects.* These are decidedly less in dilatation than in aneurysm, but, as noted in the discussion of the physical signs, they may be marked. Severe pressure signs, especially thoracic pain, speak against dilatation and for aneurysm. Certainly, continuous pain is rare in dilatation and the evidences of severe pressure, dyspnoea, stridor, etc., are apparently unknown. The variation in the pressure signs in dilatation has been noted.

2. *Intrathoracic Tumor.* This may give difficulty, but the pressure signs of tumor are likely to be more marked. The visible pulsation, usually so characteristic of diffuse dilatation, is not likely to be present. In a case in which there is doubt from the physical signs the examination with the fluoroscope will usually settle the question at once.

3. *Malposition of the Aorta.* If the aorta is unusually twisted, and lies further to the right than usual, there may be visible pulsation to the right of the sternum and an increase of dulness, or in patients with scoliosis, the vessel may be out of the normal position. The same may be seen in some of the thoracic deformities due to rickets with displacement of the heart and aorta, or in instances of marked changes with shrinking of one side of the thorax. The general features should suggest the diagnosis, and if there is doubt the x-ray examination would decide without difficulty.

In the distinction between saccular aneurysm and dilatation or malposition of the aorta, the continuance of the signs and symptoms without any great change has to be kept in mind. While a saccular aneurysm may show but little change during a considerable period, as a rule it tends to be progressive. In the absence of cardiac features, diffuse dilatation may apparently go on indefinitely without any marked change.

4. *Angina Pectoris.* The complaint of thoracic pain may suggest this diagnosis, and until the patient can be observed for some time a decision may be difficult. There is no reason why pain similar to that of angina should not occur in dilatation, especially in view

of the explanation which ascribes the pain of angina to disease of the first part of the aorta. There are certain features which are generally distinctive. The pain in dilatation is rarely so severe as in angina, is often described as more a feeling of oppression than of pain, may persist for longer periods, occurs not infrequently on the right side, and is sometimes felt in both arms. This last should always suggest dilatation. The pain in dilatation does not often seem to be caused by exertion, in fact several patients found that moderate physical exertion relieved the pain. In only one case did sweating occur with the pain. In no case, so far as known, has death occurred during an attack of pain.

5. *Cardiac Disease.* As Hodgson emphasized, the symptoms of dilatation of the aorta are often regarded as due to cardiac disease. When this does not co-exist a careful examination should prevent any mistake.

TREATMENT. Any associated vascular condition, valvular or muscular insufficiency, or myocarditis, demands its usual treatment. When present, so far as treatment is concerned, they give the usual indications. As regards dilatation itself, the main points are as follows:

Rest. There is no universal rule, and the question must be decided for each patient. If there is pain, dyspnoea, distress, or oedema of the feet, a period of absolute rest is advisable until relief is obtained. But rest should not be too prolonged, and in an ordinary case there does not seem any advantage in more than two or three weeks. Prolonged periods of physical rest are not advisable, and rest from worry and the strain of daily troubles seems more important. A long vacation is advisable if it be possible. In the laboring classes, to which so many of these patients belong, the problem is more difficult. Occupations which involve severe strain should be given up and every effort made to have the patient employed at some lighter task. When the patients are free of symptoms a certain amount of exercise is an advantage, if the associated conditions do not forbid. Several of the patients in this series find golf an excellent form of exercise.

Diet. This should conform to the general rules for arteriosclerosis. Reduction in the amount is most important, and meat especially should be limited in amount. Alcohol is best omitted, and fluids should not be taken in large amounts.

Bowels. It is most important to keep these freely open, for constipation seems to be especially harmful. Such purgatives as senna, aloes, cascara, and phenolphthalein may be given, and an occasional mercurial (nothing is better than 5 grains of gray powder) may be given at night followed by a saline in the morning.

Medicinal. There is no drug which can have any marked effect on the aorta, for the damage is done. Potassium iodide should always be given and small doses (3 to 10 grains) are probably best, over considerable periods of time. The vasodilators are usually

not indicated; if high pressure is present they may be tried cautiously. Digitalis is not indicated for the aortic condition alone and may do harm. For the attacks of pain—if severe enough to demand treatment—codeine may be given by the mouth; morphine is rarely required, but should be given if the pain is very severe. Some patients, even with a low blood pressure, find that nitroglycerin ($\frac{1}{100}$ to $\frac{1}{50}$ grain) gives almost immediate relief, and there can be no objection to its use. Others find relief from a dose of aromatic spirit of ammonia (3i) with spirit of chloroform (mxx).

In general, it may be said that a quiet even life, with avoidance of physical and mental strain, a diet limited especially in amount, open bowels, and meeting special indications when necessary, are the main points. With these we may hope to give the patients in whom the heart is not markedly affected many years of comfortable life. When cardiac breakdown appears, it must receive proper treatment.

CONCLUSIONS. 1. Dilatation of the aorta, considered apart from aneurysm, is relatively common and probably occurs more frequently than aneurysm.

2. Two main etiological factors stand out—(a) acute infections, notably rheumatic fever, and (b) those which cause general sclerotic changes.

3. The symptoms often suggest disease of the heart itself.

4. The physical signs are often very definite, of which visible pulsation in the upper interspaces, dulness over the upper sternum and adjoining interspaces, and the fluoroscopic examination are the most important.

5. Pressure signs are comparatively common, but are rarely severe.

6. The diagnosis can usually be readily made from aneurysm.

7. The outlook as regards dilatation is good.

HEART BLOCK WITH AN INDICATION OF GENUINE HEMISYSTOLE.¹

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THE case of heart block which furnished the basis for the observations which we wish to report was not of such exceptional character that a separate publication of the clinical features would be

¹ Read at a meeting of the Association of American Physicians, Washington, D. C., May 3 and 4, 1910.

of value; but the numerous tracings which were obtained furnished some interesting information and by lucky chance one of these proved of unusual importance in throwing some light on the possibility of true hemisystole. We shall give only the outlines of the history and clinical aspects of the case and then proceed to the discussion of the more interesting features.

The patient was an Italian, aged thirty-nine years, a cabinet maker, and married. Three years ago pains in the epigastrium occurred. One year ago he had a severe attack of the same pain with an attack of syncope, but noticed nothing wrong with his heart. He had a fainting attack in August, 1908. Ten days before admission to the University Hospital he had epigastric pain, and was in bed for a few days. On returning to work the pain recurred at once, and he then noticed that it came with each beat of the heart and that the heart was beating very slowly. He went home, where he had several attacks of faintness, vertigo, and vomiting.

When twenty-three years old he had a suppurating bubo and a sore on the penis. No secondaries followed, but after leaving the hospital where he went for treatment several of his teeth fell out. He has four living healthy children; his wife had one miscarriage before the four children were born. He has always been a healthy man, although he has not felt quite so well during the last three years. He has some pain along the edge of the tibiae, especially in winter. The Wassermann reaction was positive.

The heart was enlarged one and one-half inches to the right of the sternum, but not beyond the left midclavicular line. A long systolic murmur was heard, and a dull second sound. When admitted, on February 5, 1910, at 6.30 P.M., the pulse rate was 62. The next morning it was 76, but it rapidly fell to 22 by noon, and did not rise above 34 until 6 A.M. on February 9.

The features that we wish to discuss are the following:

1. That although for a time complete block existed and later partial heart block, during the patient's stay in the hospital no Stokes-Adams syndrome was present.

2. That the complete block, after the administration of atropine, promptly changed to an incomplete block with a 3 to 1 rhythm, then to a 2 to 1 rhythm, and later to a normal rhythm.

3. That the 2 to 1 rhythm and the normal rhythm for a time alternated one with the other, and a number of tracings were obtained showing this change while the tracings were actually being made.

4. That it furnished indications of genuine hemisystole during the transition of the normal rhythm to a 2 to 1 rhythm.

5. That from this same tracing it could be demonstrated that the origin of the c wave is the right ventricular contraction, rather than the carotid pulsation.

6. That the *a-c* interval is longer in such cases as this during normal rhythm, while it may be normal in length during partial block.

7. That the auricular rate becomes faster when the normal rhythm changes to a 2 to 1 rhythm, and slower when the opposite change occurs.

8. That explanations were suggested for the increased or decreased auricular rate during block and normal rhythm and for the irregular ventricular rhythm during complete block.

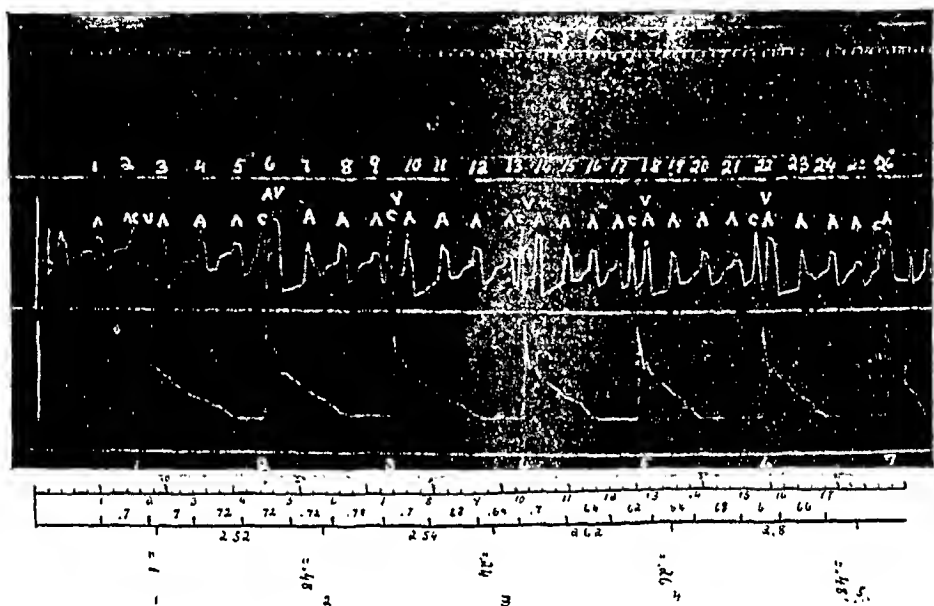


FIG. 1.—Tracing made February 6, 1910. Complete block.

1. A study of tracings 1, 2, and 3, made on February 6 and 8, shows that the block was complete, and that during this time the radial pulse fell as low as 17 to the minute, and pauses were noted between ventricular contractions of as much as 5.4 seconds. Several times 7 auricular contractions were observed between 2 ventricular ones, and yet not the slightest evidence of any Stokes-Adams syndrome was noted during the patient's stay in the hospital. During the phase of complete block the average ventricular rate from 35 measurements taken from 8 different tracings was 19.2 per minute, while the average auricular rate from 174 measurements was 80.7 per minute, a little more than four times as many to the minute.

2. A study of tracings 2 and 3, made at 1.30 P.M. on February 8, shows a complete block at that hour, and tracing 4, made 4 hours later after two hypodermic injections of atropine had been given—one at 1.30, of $\frac{1}{100}$ grain, and another at 4.30 of $\frac{1}{75}$ grain—shows that the complete block has changed to an incomplete one with a 3 to 1 rhythm. In tracing 4 the auricle was beating about

81 times per minute and the ventricle 27. Atropine was then given by the mouth every third hour, $\frac{1}{200}$ grain for two days, then withheld for four days, and then given again for a week. Tracings on the ninth day after the change from complete block to incomplete block, with a 3 to 1 rhythm, showed a 2 to 1 rhythm, and thereafter up to the present date the tracings have shown either a 2 to 1 rhythm or no block at all. He has apparently had no return of the complete block since the two hypodermic injections of atropine on February 8.

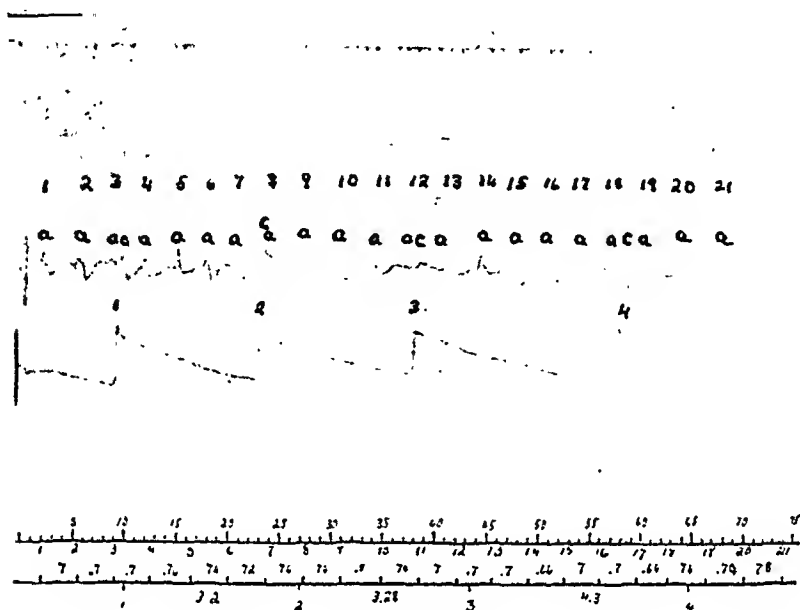


FIG. 2.—February 8, 1910. Before atropine was given. Complete block. Irregular ventricular action.

Figs. 3, 4 and 5 can be well considered together. On examining tracing 5 it will be observed that the normal rhythm changes suddenly to a 2 to 1 rhythm, brought on possibly by a deep breath that the patient had taken about seven seconds before, though more probably coming on spontaneously, as at this time the 2 to 1 rhythm and the normal rhythms frequently alternated. It will be seen that the first six *a* waves are followed, as they should be, by a *c* wave and accompanied by a wave in the radial tracing, but that the seventh *a* wave is not followed by a *c* wave, although accompanied in the radial by a wave exactly like the preceding one. The eighth *a* wave is followed by a *c* wave and accompanied by a wave in the radial, the ninth *a* wave is not followed by a *c* wave and is not accompanied by a wave in the radial, and from here on the 2 to 1 rhythm which has been started persists. Now, how are we to explain why the seventh *a* wave is not followed by a *c* wave, although accompanied by a wave in the radial tracing? There being an *a* wave shows that the right auricle con-

tracted, and there being a wave in the radial shows that the left ventricle contracted following the auricular contraction, but why is there no *c* wave? If the *c* wave is caused largely by the carotid

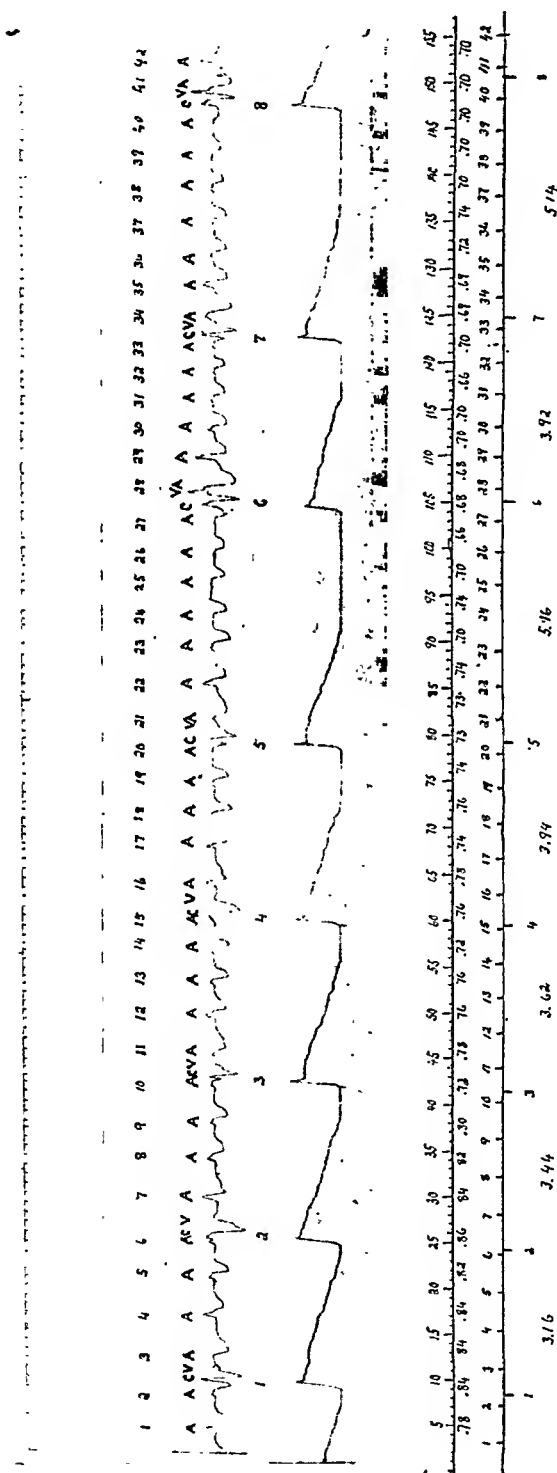


Fig. 3.—February 8, 1910. Before atropine. Complete block. Irregular ventricular action.

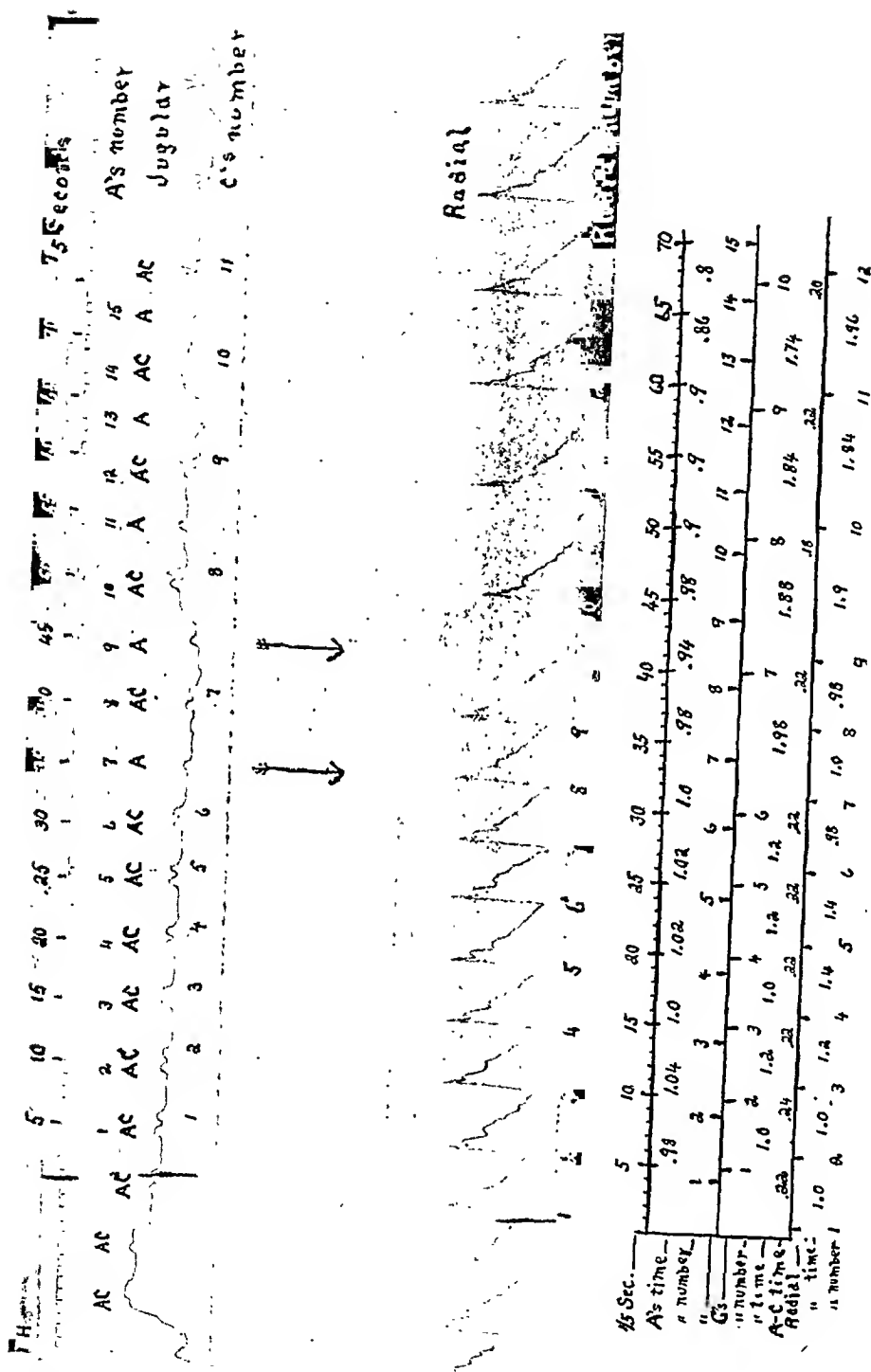


FIG. 5.—February 17, 1910. Change from the normal rhythm to a 2 to 1 rhythm. Note that the seventh a wave is *not* followed by a c wave although it *is* accompanied by a wave in the radial (No. 8), and that the ninth a wave is *not* followed by a c wave and is *not* accompanied by a wave in the radial.

typical examples of *pulsus bigeminus*. Hering, in particular, has been very insistent upon this point, and thinks that the term *hemisystole* should be abolished, because although on inspecting the hearts of dying animals one can observe one ventricle beating after the other has ceased to beat, or one ventricle contracting more rapidly than its fellow, such contractions as these can only be noted in dying hearts, and are not, he thinks, compatible with life.

Barker and Hirschfelder,³ in a very important paper entitled "The Effects of Cutting the Branch of the His Bundle going to the Left Ventricle," reported that they found, when they cut the left branch without injuring the right, that complete block resulted, but both ventricles contracted synchronously. In one experiment no block resulted, and they, therefore, conclude that the bundle of His plays little if any role in the coordination of the two ventricles.

Eppinger and Rothberger⁴ report some studies of the consequences of section of Tawara's branches of the conducting apparatus. Their observations of the electrocardiograms they obtained showed after section of the left branch a curve significant of right-sided extrasystoles, and on section of the right branch, left-sided extrasystoles. When the ventricular contractions are infrequent, the auricular waves can be seen before the ventricular. The authors conclude from their studies, that the stimulus originating in the auricles passes down through the bundle of His to its division and then to the left and right ventricles through the branches. When the left branch is cut, the impulse does not flow to the left ventricle, and it is, therefore, not stimulated to direct contraction; the right ventricle contracts first and the left receives its impulse in an indirect way through the right. This state of affairs is the same as occurs when in case of vagus inhibition the right ventricle is stimulated from its wall and consequently contracts before the left. The authors obtained somewhat similar results in a previous study in which cardiac lesions were produced by injections of silver nitrate solution.⁵ They refer to the fact that Asehoff had raised the question in connection with his pathological studies whether a lesion of one of the Tawara branches or its division would not impair cardiac action, and Monekeberg has shown that ecchymotic hemorrhage and subendocardial fatty metamorphosis is apt to occur in the position of the conducting bundle and its branches. The authors finally call attention to the fact that in their operations on dogs, section of one Tawara branch was followed by gallop-rhythm characterized by a disturbance of synchronous contraction of the ventricles. In the Medical Clinic of Vienna, they recently observed two fatal cases in which during life the form of the electrocardiogram had suggested a diagnosis

³ Trans. Assoc. Amer. Phys., 1909.

⁵ Wien, klin. Woch., 1909, No. 31.

⁴ Ztsch. f. klin. Med., lxx, 1.

of interruption of conduction to one ventricle. The autopsies showed macroscopically a large myocarditic lesion in the septum. How far this may have invaded the conducting tissues will have to be determined by careful microscopic examination.

Pulsus bigeminus simulates hemisystole because the second or smaller beat, which is an extrasystole, although giving a distinct wave in tracings made from the apex and in the neck does not give any wave in the radial. McKenzie has always insisted that the *c* wave was caused by the carotid, and this view has been adopted by some and rejected by others. It is our belief that the *c* wave can be caused by the carotid artery if the recorder be placed directly over this vessel, but we also believe that by moving the recorder a venous wave can be obtained that has nothing to do with the carotid but comes from the right ventricle. In other positions both these factors undoubtedly may take part in the formation of the so-called *c* wave.

6. A study of a number of the tracings showed that when the rhythm was normal the *a-c* interval averaged 0.2208 second, this figure being taken from 60 measurements; when the rhythm was 2 to 1 the *a-c* interval averaged 0.205 second, as estimated from 24 measurements; when the rhythm was 3 to 1 the same figure was obtained from the average of 7 measurements. Greater variations were noticed in the length of the *a-c* interval during normal rhythm than at other times. No evidence of progressive increase in the length of the *a-c* interval leading up to a partial block was found at any time.

7. That the auricular rate is slower when normal rhythm exists and faster when a 2 to 1 rhythm has come on, is found to be true from a series of measurements taken from a number of tracings. These changes in rate come on immediately after the change one way or other sets in, but we find that there is a greater immediate disturbance of the auricular rate of contraction when the rhythm changes from a 2 to 1 to a normal rhythm than when the normal changes to a 2 to 1 rhythm. Thus, we find an average drop of some 17.9 beats per minute in the rate or a change from 74.2 to 56.3 when there was a restoration to normal rhythm; while when the normal rhythm changed to a 2 to 1 rhythm there was an increase in the auricular rate of but 10.6 beats in the minute or a change from 59.7 to 70.3. These averages were obtained by measuring only about 20 beats immediately following the change in rhythm.

8. In attempting to determine the cause of greater auricular rate during 2 to 1 or 3 to 1 rhythm than when no dissociation existed, it has occurred to us as reasonable that the interference with auricular outflow, which is present at each alternate or third auricular contraction, would necessarily leave the auricle relatively unemptied and would thus occasion an earlier stimulus to contraction, which would result in a more rapid rate. When a change from normal to

2 to 1 rhythm occurs the quickening of auricular rate is less prompt than is the slowing when a 2 to 1 rhythm changes to the normal. An explanation for this circumstance may be found in the fact that resumption of normal rhythm after a 2 to 1 rhythm at once relieves the auricle of back pressure and the consequent stimulus to increased rate. Such a sudden relief is followed by prompt re-adjustment of auricular activity, whereas the effect of change from normal to a 2 to 1 rhythm and the consequent gradual overfilling of ventricle and auricle would be met by a slower response.

In this case during the time of complete block the ventricular rhythm was not at all times regular, as has been already mentioned, although the ventricle usually contracted about 20 times to the minute, or about every three seconds; at other times there were irregular pauses, the longest being 5.4 seconds. There were, however, no extrasystoles at any time. It is known from physiological experiment that, owing to poorly developed or retained independent rhythmicity, a portion of the ventricle, as, for example, the severed apex of the ventricle, tends to cease contracting after a time and will resume regular contractions only after an external stimulation. It is, therefore, possible that the continued action of the ventricle sometimes for long periods and despite occasional long pauses in cases of complete block may be due to the stimulus of distention with blood resulting from the continued auricular action.

THE TREATMENT OF ANEURYSM OF THE AORTA BY THE INTRODUCTION OF WIRE AND THE PASSAGE OF A GALVANIC CURRENT.¹

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ANEURYSM of the aorta is essentially a fatal disorder sooner or later, partly on account of the resulting interference with the blood distribution and pressure phenomena, but largely and inherently because of the underlying degenerative state of the vessel wall, so that if correction or repair be effected in one situation, active manifestations are likely to appear in another situation. The affection is almost invariably associated with more or less widespread atheroma of the arterial system, and antecedent syphilis appears to be far and away the commonest cause. The dilatation or diverticu-

¹ Read at a meeting of the Association of American Physicians, Washington, D. C., May 4, 1910.

lation of the bloodvessel must, accordingly, be looked upon merely as a local expression of changes widely distributed throughout the vascular system, and accordingly the results of any therapeutic procedure can at best be only palliative, except in the small group of cases in which the lesion arises from purely local influences, such as traumatism or adjacent disease. Nevertheless, it will not be gainsaid that measures of temporary relief are often indicated, either for the amelioration of symptoms or for the prolongation of life. In this connection the fact should not be ignored that under certain conditions life may be continued for many years in the presence of an aneurysm and also that a sacculated aneurysm of the aorta may, and occasionally does, undergo spontaneous cure by the total occlusion of the aneurysmal sac by fibrous laminated adherent clot, and be discovered at autopsy only as an incidental phenomenon. Furthermore, it is impossible to foresee the outcome of the brilliant experimental work that has been done and is being continued in the plastic surgery of the vascular system. Nevertheless, there will remain cases in which symptomatic treatment only will be possible.

In the treatment of aneurysm of peripheral vessels, with abundant anastomotic connections, deligation, with or without excision or resection of the aneurysmal sac, has yielded satisfactory and at times even brilliant results, but this mode of procedure is scarcely applicable to aneurysm of the aorta, and more particularly, its thoracic division, partly on account of anatomical limitations with respect to the establishment of a collateral circulation, and partly by reason of the practical inaccessibility of the disease focus. Various modes of treatment, dietetic, medicinal, physical, have been applied to aneurysms of the latter class, with varying measure of success. Among the most rational and most useful of these may be mentioned rest, restricted diet, ergot, iodides, calcium chloride, adrenaline, introduction of foreign bodies, electricity. Of foreign bodies there have been introduced into the aneurysmal sac substances such as horsehair, catgut, silk, watchspring, needles, and wire of various kind.

Charles H. Moore and Charles Murchison² first employed fine iron wire in this manner, introducing twenty-six yards through a cannula into an aneurysm of the thoracic aorta. The tumor was at first reduced in size, but subsequently it became larger, and the patient died on the fifth day. Postmortem examination disclosed abscess of the left kidney and pericarditis.

The possibility of treating aneurysm by transfixion with needles occurred to Velpeau³ and to Benjamin Phillips,⁴ while Ciniselli⁵

² Medico-Chirurgical Transactions, 1864, xlvii, 129.

³ Memoires de l'Academie des Sciences, December, 1830.

Medical Gazette, 1831, 499; also pamphlet, A Series of Experiments for the Purpose of Showing that Arteries may be Obliterated without Ligature, Compression, or the Knife, 1832.

⁵ Gazette des Hôpitaux, 1868.

recommended galvanopuncture or electrolysis by means of needles introduced into the aneurysmal sac.

Burresi and Corradi^a introduced 42 cm. of No. 30 annealed wire through a cannulated needle into the sac of a large aneurysm of the ascending division of the arch of the aorta, and passed a constant current. Temporary improvement ensued, but death took place three and a quarter months after the operation. This latter procedure variously modified has since been carried out in a moderate number of cases—of which I have been able to tabulate 38—and the results appear to justify its employment under suitable conditions. It is applicable only to sacculated and not to fusiform aneurysms, particularly if lesser measures have failed, and even and perhaps especially when alarming symptoms are present or rupture is threatened. The most that can be hoped for under such circumstances is amelioration of symptoms and prolongation of life, and these ends have been attained in most instances in which the procedure has been employed. In isolated instances the inevitable fatal issue appears to have been hastened, but in the vast majority the intervention has been justified by the results.

The technique of the procedure is extremely simple. Under aseptic conditions a hollow needle of gold, silver, or platinum, insulated except at its tip, is introduced to a considerable distance into the most prominent part of the aneurysmal sac, care being taken to avoid puncture of the remote opposite side of the vessel-wall. Through the needle gold or silver wire is fed in amount sufficient loosely to fill the sac. Ordinarily ten or twelve feet of wire will be sufficient. Should the wire kink before the desired amount is introduced, the needle may be withdrawn and introduced in another situation, or a second needle may be introduced, and wire insinuated through it. Indeed, several needles may be introduced at the same sitting. The end or ends of wire are connected with the positive pole of a galvanic battery and a current gradually increased to 60, 80, or 100 milliampères and as gradually decreased, is passed over a period of from an hour to an hour and a half. The negative pole of the battery is placed upon some indifferent point, as upon the back. A spurt of blood usually follows introduction of the needle, but the hemorrhage is not considerable and it soon ceases. Pulsation may begin to subside during the introduction of the wire, but, as a rule, this effect does not appear until the passage of the current, and at the same time the patient often expresses relief from distressing symptoms, such as pain and dyspnoea. In many instances the improvement is progressive and persists for a varying period of time, and in one case it was maintained for nearly twelve years. The operation is remarkably free from accident or complication, transient hemiplegia having been exceptionally observed. Death

^a *Lo Sperimentale*, April, 1879, p. 445.

may result from hemorrhage or the effects of pressure and exhaustion, or from rupture of a second aneurysm, and at times from an entirely unrelated cause. Only sacculated and not fusiform aneurysms are suitable for the operation. Experience and experiment have shown that gold or silver wire is the best to employ, the latter having the advantage of lesser cost. The positive pole is preferred for connection with the wire on account of the firmer clot produced at this pole.

In addition to the recorded cases, I am able to report two that have recently been under my observation.

CASE I.—A sheetmetal worker, aged sixty-four years, was admitted to the Philadelphia General Hospital March 26, 1909, complaining of dyspnea, pain on both sides of the chest, cough, expectoration, headache. The dyspnea has been present for a year, and had become worse six weeks previously. At this time the pain in the chest appeared, and a cough of long standing became aggravated. The man had worked at his trade until four weeks before admission to the hospital, when he was compelled to give up on account of the difficulty in breathing. Physical examination disclosed the signs of effusion into the left pleural cavity, and on aspiration about three pints of clear serous fluid were evacuated. The apex-beat of the heart, which previously had been one and a half inches to the right of the sternum, receded to the left of the sternum. The normal heart sounds were replaced by murmurs, but little transmitted. The voice was hoarse, and there was a metallic cough. Bulging, with pulsation, was visible on the upper anterior aspect of the left chest, with dulness on percussion and a to-and-fro murmur on auscultation. Tracheal tugging was distinct. The percussion note over the greater part of the left chest was dull, with diminished vocal resonance and fremitus, and friction sounds toward the base. Over both lungs bubbling rales were audible. On laryngoscopic examination the left vocal band was found immobile. The urine was free from albumin and sugar. X-ray examination disclosed an aneurysm of the aorta.

As the swelling and the pulsation of the left chest increased and the general symptoms grew worse the proposition was made to the patient that wire be introduced into the sac and a galvanic current be passed, and in this he acquiesced. Accordingly, on April 24, 1909, after injecting $\frac{1}{4}$ grain of morphine hypodermically, and inducing local anesthesia with cocaine, Dr. Ralph S. Lavenson introduced at the most prominent point an insulated hollow gold needle in the second interspace just to the left of the sternum. A small amount of dark, thick blood oozed from the needle. About twelve feet of gold wire was introduced into the sac, blood meanwhile flowing more freely. The end of the wire was connected with the positive pole of a galvanic battery, while a large wet pad connected with the

negative pole was applied to the back. The current was started at 5 milliampères and thus continued for three minutes, being increased 5 milliampères every succeeding three minutes until a total of 60 milliampères was reached. It was maintained at this level for ten minutes, and then gradually reduced 10 milliampères every three minutes. Fifty-eight minutes were consumed in the passage. During its progress pulsation diminished. The patient withstood the operation well and made no complaint of pain. Subsequently there was temporary return of the pain on both sides of the chest. For a time also a tender swelling made its appearance at the site of puncture, but this soon subsided. The patient, however, failed to gather strength, and troublesome cough persisted, and without the development of other symptoms death took place from exhaustion on May 22, 1909, four weeks after the operation.

There was some delay in securing an autopsy, and this was not held until five days after death. The body has been embalmed and was in a good state of preservation. The right lung was bound by moderate adhesions, which were readily detached. The left lung was held by more numerous and firmer adhesions, and it was greatly compressed. The anterior mediastinum was occupied by the heart and a large, firm mass. The heart was in a somewhat transverse position, the right auricle being situated to the right and the right ventricle to the left, while the left auricle and ventricle were altogether posterior. The pericardial cavity was obliterated by adhesions. The ascending and transverse portions of the arch of the aorta were the seat of an immense aneurysm as large as a child's head, and almost entirely filled with clot which in places had undergone fibrous transformation, and in the midst of which was a coil of gold wire. The descending portion of the arch and the thoracic aorta were the seat of marked atheroma, with calcareous deposits. The liver was large, hard, and cirrhotic. The kidneys were large and cyanotic, with parenchymatous and interstitial changes. The spleen was soft and voluminous. The lungs were firm and on section frothy.

CASE II.—V. M., an Italian laborer, aged fifty-nine years, was admitted to the Philadelphia General Hospital, September 10, 1908, complaining of precordial pain, cough, expectoration, dyspnoea, and weakness. He had been a saloonkeeper for thirty-two years and had indulged in alcohol to excess. He had suffered from several of the diseases of childhood, from smallpox at six, and he had had an attack of gonorrhoea at twenty, and a chancre at thirty. For eight months he had been complaining of pain in the precordium, progressive in severity, radiating in the course of the great vessels and extending down the left arm, together with cough and expectoration. The pulse was small, slow, and thready, the right smaller and slower than the left. Pulsation was visible in the vessels of the neck. The chest

was barrel-shaped and presented a pulsating swelling to the left of the sternum between the second and fourth intercostal spaces, and yielding dulness on percussion. No thrill was palpable, but a bruit was audible on auscultation. The action of the heart was deliberate, rhythmic, and forcible; the first sound was clear, the second accentuated at the base. The pupils were moderately dilated, but they reacted to light and in accommodation. The urine was free from albumin and sugar. Skiagraphic examination disclosed an aneurysm of the arch of the aorta. On September 28, fourteen feet of gold wire was introduced by Dr. Ralph S. Lavenson into the pulsating mass, and a galvanic current was passed. The current strength was begun at 5 milliampères and was gradually increased to 75 milliampères and as gradually reduced. The patient was somewhat restless during the course of the procedure, and he coughed slightly with each increase in the strength of the current. Relief was afforded by a hypodermic injection of morphine, $\frac{1}{4}$ grain, and the patient slept for a portion of the time. Pulsation soon diminished and became almost imperceptible. Pain, however, persisted, and at a later date pulsation returned. On May 1, 1909, the patient went to visit friends, and he returned on May 5 with a pulsating mass of increased size at the site of the earlier swelling. Death took place suddenly on May 6, seven and one-fourth months after the operation.

On postmortem examination a globular swelling was visible upon the anterior aspect of the left side of the chest between the second and fifth ribs and the median and nipple lines, and the centre of which exhibited a dark-red discoloration. The underlying third rib was fractured. The right pleural cavity was free and the right lung was covered at its apex by a small area of thickened pleura, but it was in other respects normal. The left pleural cavity contained 200 c.c. of slightly cloudy, straw-colored fluid, in which floated flakes of fibrin. The pleural surfaces were moist and glistening. The left lung was pale gray in color and crepitant throughout. On section a considerable amount of frothy fluid escaped. The pericardial cavity contained a large amount of currant-jelly clot under such pressure that it was forcibly extruded when the pericardium was incised. The heart was flabby and covered by a considerable amount of epicardial fat. The myocardium was pale and cloudy. All of the chambers of the heart were dilated, but the walls were not hypertrophied. The valves and orifices presented no abnormality. The aorta was extremely atheromatous, the intima in places being punctured and fissured. The ascending and transverse portions of the arch of the aorta were greatly dilated and from the anterior aspect of the latter bulged a large sacculated aneurysm measuring 8 x 6 cm. The sac was largely filled by organized thrombus and recent blood clot, in the midst of which,

loosely coiled, lay 350 cm. of fine gold wire. The overlying third rib was partially eroded and fractured, and the aneurysm was adherent to the second and fourth ribs. A short distance above the aortic cusps the vessel wall was softened and eroded, and it was at this point that the fatal hemorrhage into the pericardium had taken place. Several other weakened spots in the wall with beginning bulging were visible in other parts of the aorta. The spleen was considerably enlarged. It was friable and it tore in removal. Its structure was pale, the capsule presenting a variegated appearance, with dark and red spots. The kidneys were pale and flabby, the capsule stripping easily and leaving a smooth surface behind. On section they presented a cloudy appearance, the cortex being slightly increased in thickness and pale in color. The right kidney was smaller than the left. The liver was enlarged and measured 20 x 18 x 9 cm. It was pale and flabby and its capsule was smooth. Section presented a dirty yellow appearance; the acini were not visible.

The accompanying table comprises 34 cases that I have been able to collect from the literature, together with 2 cases recently reported by Beardsley, Rhoads, and Saurman at a meeting of the College of Physicians of Philadelphia, February 3, 1910, and the two cases of my own.

In addition Hunner⁷ refers to a case of Dr. John Neff, of Baltimore, in which operation was performed on three occasions by D. D. Stewart, of Philadelphia, and apparently not otherwise reported. The patient was a travelling salesman, with a large thoracic aneurysm; ten feet of wire was introduced February 5, ten feet April 1, and five feet June 5. Death took place from rupture and hemorrhage November 17.

Dr. Robert N. Wilson, Jr., of Philadelphia, informs me that he has treated 3 cases of aneurysm of the ascending portion of the arch of the aorta and 1 case of aneurysm of the descending portion by the introduction of 15 feet of gold wire and the passage, throughout an hour, of a galvanic current gradually increased to 160 milliampères and then gradually diminished. In three of the patients death appeared imminent, and although they were helped symptomatically, life was prolonged but a few days. One had been wired twice previously without advantage, and the patient was able to return to work after the third operation, and was still living at the date of Dr. Wilson's letter to me.

Of the 38 cases included in the table that I have prepared, 36 occurred in males, 1 in a female, and in 1 the sex was not mentioned. The age of the patient was mentioned in 35: Five were between twenty-five and twenty-nine, 3 between thirty and thirty-four, 6 between

⁷ Loc. cit.

thirty-five and thirty-nine, 7 between forty and forty-four, 4 between forty-five and forty-nine, 4 between fifty and fifty-four, 4 between fifty-five and fifty-nine, 1 was sixty-four, and 1 was seventy-three. The arch of the aorta was the seat of the aneurysm in 18 cases (ascending portion in 9, descending portion in 3, "arch" in 2, transverse portion in 2, ascending and transverse portions in 1, transverse and descending portions in 1), the thoracic aorta in 5, the abdominal aorta in 5, the innominate artery in 3, the subclavian artery in 2, the superior mesenteric artery in 2, the thoracic and abdominal aorta in 1, the splenic artery in 1, and the coeliac axis in 1. Gold wire was used in 16 of the cases, silver wire in 15, steel wire in 4, and silver-plated copper wire in 1. The duration of life following the operation was as follows: Five and one-half hours in 1, twenty-four hours in 1, forty hours in 1, forty-two hours in 1, two days in 1, five days in 1, six days in 1, seven days in 1, nine days in 1, eighteen days in 1, twenty days in 2, three weeks in 1, twenty-three days in 1, three and one-half weeks in 1, four weeks in 1, five weeks in 1, forty-seven days in 1, two months in 1, eleven weeks in 1, three and one-fourth months in 1, four months in 1, five months in 1, six months in 2, seven months in 1, seven and one-fourth months in 1, eight months in 2, eight and one-half months in 1, ten months in 1, fourteen months in 1, three and one-half years in 1, five years in 1, eleven years and eight months in 1. One patient was living three years after the operation, but his subsequent history is unknown (Kerr, loc. cit.).

CONCLUSIONS. Aneurysm of the aorta is essentially a fatal disorder, although exceptionally spontaneous cure takes place. Accordingly, treatment can, as a rule, be only palliative, relieving symptoms and prolonging life. Deligation is inapplicable from anatomical considerations. Rest, ergot, iodides, gelatin, calcium chloride, adrenalin chloride and introduction of foreign substances, with or without the passage of a galvanic current, have been employed. Horsehair, catgut, needles, watchspring, and wire of various kind have been introduced, with varying result, and a galvanic current has been passed through conducting substances. Wiring with electrolysis has been employed in a moderate number of instances, with satisfactory results in the majority. The procedure has proved simple and safe, but it is applicable only to sacculated and not to fusiform aneurysms.

Reporter.	Sex.	Age.	Situation.	Operation.	Result.	Remarks.
Bursi-Corradi, Lo Sperimentale, April, 1879, 445	M	43	Ascending arch	42 centimeters No. 30 annealed wire; 16 cells, 25 minutes	Death, three and one-quarter months	Exhaustion; rupture of second sac
Richard Barwell, Lancet, June 5, 1886, 1058	M	39	Descending arch	10 feet fine steel wire; 9 to 10 milliamperes, 70 minutes	Death, seven days	Gangrene toe
J. W. Roosevelt, Medical News, 1887, 397	M	25	Arch	225 feet fine steel wire (oo); 25 milliamperes, 30 minutes	Death, twenty-third day	Current reversed; dissecting; rupture into trachea
Robert Abbe, Medical News, 1897	M	46	Subclavian	100 feet No. 1 entgut; 8 days later 150 feet fine steel wire; 50 to 100 milliamperes, 70 minutes	Death, second day	
W. W. Kerr, Occidental Medical Times, January, 1889, 1	M	38	Ascending arch	6 feet drawn silver wire; 50 minutes	Death, eighteenth day	Fusiform
W. W. Kerr, Occidental Medical Times, January, 1889, 1	M	56	Ascending arch	Galvano-puncture; later 10 feet wire, 30 minutes	Working as a pavior three years after operation*	Fusiform
Julius Rosenstein, Amer. Jour. Med. Sci., 1891, ci, 55	M	25	Ascending arch	Galvano-puncture; later 26 feet silver wire, 30 minutes	Death, eleven years and eight months*	Rupture
D. D. Stewart, Trans. College of Physicians of Philadelphia, 1892, xiv, 68	M	30	Thoracic and abdominal	Heavy silver wire; 70 milliamperes, 1 hour	Death, ninth day	
E. P. Hershey, Therap. Gaz., 1896, 590	M		Innominate	2½ feet No. 28 gold wire; 70 milliamperes, 45 minutes	Death, fourteen months	
D. D. Stewart and J. L. Sallinger, Amer. Jour. Med. Sci., 1896, cxli, 171	M	40	Innominate	10 feet No. 30 gold wire; 30 to 80 milliamperes, 75 minutes	Death, three and one-half years	Death from cerebral thrombosis
D. D. Stewart, Trans. College of Physicians of Philadelphia, 1897, xix, 38	M	37	Abdominal	8½ feet No. 30 gold wire; 70 milliamperes, 37 minutes	Death, eight months	Abdominal section; death not due to aneurysm
W. H. Noble, Phila. Med. Journal, June 25, 1898, 1203	M	46	Transverse and descending arch	9 feet fine gold wire, 80 minutes	Death, seven months	Death from exhaustion; second aneurysm distal
H. A. Hare, Therap. Gaz., 1898, 293; 1900, 9; Penna. Med. Journal, 1898-1899, 312	M		Splenic	10 feet silver wire; 50 milliamperes, 30 minutes	Death, fifth day	Abdominal section.
D. D. Stewart, Phila. Med. Journal, Nov. 12, 1898, 1011	M	42	Thoracic	14 feet fine gold wire; up to 80 milliamperes, 80 minutes	Death, fifth day	Life prolonged; comfort afforded
D. D. Stewart, Phila. Med. Journal, Nov. 12, 1898, 1011	M	49	Abdominal	7 feet silver-plated, soft copper wire; 80 milliamperes, 50 minutes	Death, twenty-four hours	Abdominal section; strand of wire extended to aortic valves
J. C. Reeve, Annals of Surgery, 1899, xxx, 704	M	31	Ascending arch	6 feet drawn silver wire; 8 dry cells, 2 hours	Death, forty-two hours	Death from arrest of respiration
E. S. Corson, Phila. Med. Journal, March 4, 1899, 511	M	48	Arch	10 feet gold wire; 1 month later 10 feet gold wire in each of two places; 10 to 100 milliamperes, 90 minutes	Death, eight months	Life prolonged
H. A. Hare, Therap. Gazette, 1900, 9	M		Abdominal	10 feet gold wire; 5 days later 10 feet gold wire; up to 85 milliamperes, 1 hour	Death, sixth day	Death from respiratory failure
H. A. Hare, Therap. Gazette, 1900, 510	M	27	Abdominal	No. 27 undrawn silver wire; kinked; withdrawn, 12 minutes; second wire, 17 inches; third wire, 38 inches; 30 to 100 milliamperes, 85 minutes	Death, forty hours	Abdominal section; symptoms of internal hemorrhage; death probably hastened

G. L. Hunner, Bulletin Johns Hopkins Hospital, Nov. 1900, 263	M.	25	Abdominal superior mesenteric	5 feet silver wire (copper alloy); 30 to 70 milliamperes, 80 minutes	Death, twentieth day	Abdominal section; death from hemorrhage
G. L. Hunner, Bulletin Johns Hopkins Hospital, Nov. 1900, 263	M	51	Thoracic	10 feet silver wire (copper alloy); 10 to 20 milliamperes, 75 minutes	Death, six months	
G. L. Hunner, Bulletin Johns Hopkins Hospital, Nov. 1900, 263	M	39	Thoracic	10 feet silver (copper) wire; 10 milliamperes, 1 hour; after 24 days, 10 feet silver (copper) wire; 10 milliamperes, 1 hour	Death, eleven weeks	Death from compression of trachea
G. L. Hunner, Bulletin Johns Hopkins Hospital, Nov. 1900, 263	M	30	Abdominal	8 to 9 feet highly drawn sterling silver wire; 10 milliamperes, 1 hour	Death, fifth year*	Fusiform aneurysm; abdominal section
H. A. Hare, Therapeutic Gaz., 1903, 19	M		Thoracic	9 feet gold wire; second operation 6 months later	Death shortly,	Repeated copious hemorrhage
J. Daland, Penna. Med. Journal, 1903-1904, 134	M	52	Left subclavian	20 feet gold wire; 1 to 80 milliamperes, 110 minutes	Death, twentieth day	Thrombosis of carotid artery from pressure of aneurysm
Raymond Russ, Occidental Medical Times, 1903, 284	M	50	Transverse arch	1 foot No. 26 soft silver wire; 50 to 100 milliamperes, 55 minutes; 15 days later, 6 feet No. 22 silver wire; 50 to 60 milliamperes, 40 minutes	Death, five weeks	Pressure on trachea
J. L. Salinger, Therapeutic Gazette, 1903, 438	M	73	Ascending arch	16 feet wire; 5 to 65 milliamperes, 75 minutes	Death, five months	Transitory hemiplegia and aphasia on third day; death from pneumonia
R. C. B. Maunsell, British Med. Journal, June 18, 1904, 1421	M	28	Abdominal (celiac axis)	6 yards No. 28 silver wire; 1 to 65 milliamperes, 30 minutes	Death, forty-seven days	Abdominal section; hemorrhage
H. A. Ballance, Lancet, Oct. 1, 1904, 939	M	44	Ascending arch	8 feet No. 9 silver wire; 24 to 42 milliamperes, 45 minutes	Death, ten months	Great relief of symptoms; old emboli kidneys; recent infarct lung
H. A. Hare, Therapeutic Gazette, July, 1905, 433	F	50	Transverse arch	8 feet gold wire; 5 to 50 milliamperes, 30 minutes	Death, six months	
H. A. Hare, Therapeutic Gazette, July, 1905, 433	M	42	Innominate	2 feet gold wire; 5 to 30 milliamperes, 40 minutes	Death, two months	Exhaustion; interference with respiration and deglutition; no trace of wire at autopsy
H. A. Hare, Therapeutic Gazette, July, 1905, 433			Thoracic	9 feet gold wire; 5 to 50 milliamperes, 45 minutes	Death, four months	Pressures; exhaustion
Gaston Torrance, Alabama Med. Journal, 1905-6, xviii, 487	M	40	Descending arch	5 to 6 feet No. 27 drawn silver wire; 10 to 20 milliamperes, 1 hour	Death, three and one-half weeks	Hemorrhage; rupture into esophagus
S. A. Griffiths, Lancet, Aug. 12, 1905, 442	M	37	Abdominal	1 foot fine silver wire; kinked; more wire (6 feet); 15 to 25 milliamperes, 15 minutes	Death, five and one-half hours	Abdominal section; double loop of wire had passed into aorta two inches; wire connected with negative pole
E. J. G. Beardsley, Samuel Rhoads, J. Shelley Saurman ⁷	M	57	Descending arch	32 feet No. 26 gold wire; 5 to 60 milliamperes, gradually increased and decreased	Comfortable after four months	
E. J. G. Beardsley, Samuel Rhoads, J. Shelley Saurman ⁷	M	37	Ascending arch	18 feet No. 26 gold wire; 5 to 60 milliamperes, gradually increased and decreased	Death, three weeks	Death from rupture of aneurysm; fusiform
A. A. Eshner	M	64	Ascending and transverse arch	12 feet gold wire; after 8 weeks 10 feet gold wire; 5 to 50 milliamperes, 58 minutes	Death, four weeks	Death from exhaustion
A. A. Eshner	M	59	Ascending arch	14 feet gold wire; 5 to 75 milliamperes	Death, seven and one-quarter months	Rupture into pericardium

ORTHODIAGRAPHY IN PATHOLOGICAL CONDITIONS OF THE HEART AND AORTA¹.

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It is scarcely necessary to say that any instrument or method of examination which renders the science of medicine more exact, or which enables us to make more complete and accurate records of pathological findings, should be appreciated by the profession, even though the field of usefulness be comparatively small.

The orthodiagraph is an instrument which enables us to outline in its exact size any organ or object of which the Röntgen rays will cast a sufficient shadow. This result is obtained by carrying a small pencil of the ray through a series of parallel positions about the borders of the object under observation, and recording the results upon a sheet of paper placed behind the subject.² By fixing at the same time landmarks such as the outline of the body, the ribs, the diaphragm, etc., the orientation of the object or organ may be made exact.

ACCURACY OF RESULTS. We speak of outlining the object under observation in its exact size, but such a statement requires some modification. The heart and aorta are in constant motion, expanding and contracting, and it therefore becomes necessary to choose which part of the cycle is to be pictured. We have chosen expansion because it allows of greater accuracy, it being easier to mark the shadow of the heart or aorta as it makes its widest excursion into the light area of the lungs. If the heart is pulsating very rapidly it becomes much more difficult to make a correct diagram because of the fleeting character of the shadow cast. The condition of the lungs is also very important. If they contain dark areas in the neighborhood of the great vessels it may be impossible to obtain satisfactory results. Marked œdema due to cardiac weakness may also render it impossible to outline the heart.

THE PRACTICAL VALUE OF ORTHODIAGRAPHY. A year ago we³ reported a series of tables compiled from orthodiagrams of the hearts of about one hundred normal men and women, showing the measurements of the anterior projection of the heart's shadow for

¹ Read at a meeting of the Association of American Physicians, Washington, D. C., May 3 and 4, 1910.

² For description of the technique, see Claytor and Merrill, *AMER. JOUR. MED. SCI.*, 1909, cxxxviii, 549.

³ *I. op. cit.*

various weights (the division according to weight was found to be the most practical method). By reference to these tables it is possible to tell just how much and in what direction a heart shadow under consideration may depart from the average. However, after some experience in making diagrams of the heart, it is seldom necessary to resort to the actual measurement of the resulting figure, as one may see at a glance whether or not there is any material distortion of the outline. It should also be remembered that even in normal individuals of like weight and height there may be considerable difference in the size of the heart.

POSSIBILITIES OF ERROR IN ORTHODIAGRAPHY. There is seldom any difficulty in fixing the landmarks as they may be called. The outline of the neck, shoulders, and body, together with the position of as many of the ribs as are desired, can be marked with the pointer before the current is turned on. The interior of the thoracic cavity is easily marked, if the lungs are clear, and the position of the diaphragm determined at any stage of the respiratory cycle which may be desired. We have found that the median line is more accurate when established by measurements made from the lateral aspects of the interior of the thoracic cavity, as the xiphoid is so often distorted and the umbilicus is a little too low for convenience as a fixed median point.

The right auricular curve is usually clearly seen, but on reaching the right vascular curve there may be some difficulty. If this curve happens to be formed by a dilated ascending aorta its pulsations render it easy of recognition, but if the descending aorta is the object to be outlined the absence of motion makes it more difficult to distinguish, as enlarged or dark glands may be projected into this area. The aortic curve, while in some instances casting but a faint shadow, can usually be clearly seen. Below this the pulmonary curve, made by the pulmonary artery as it plunges beneath the arch of the aorta, comes into view. Then the left auricular curve may be seen. In normal cases this curve is often not perceptible, as it is produced by the left auricular appendix, while in instances of dilated left auricle this position of the heart casts the shadow. The left auricular curve is most marked in stenosis of the mitral valve. Below this comes the left ventricular curve, which is usually clearly seen until the apex is reached, when because of its transparency, rapid and wide excursion of movement, and because of its close proximity to the diaphragm in all cases, and to the liver in some cases, it is more difficult to see.

There is sometimes difficulty in distinguishing a dilated aorta from a true aneurysm (Fig. 5), but in most instances aneurysms of the ascending, transverse, and descending aorta are clearly seen. The condition of the lungs in aneurysmal cases is sometimes such as to render it impossible to outline the dilated vessel except in its upper portion.

It has been pointed out by Franz M. Groedel⁴ that it is very necessary to bear in mind the remarkable motility of the heart. Thus, diagrams taken of the same subject in the same position during quiet respiration, inflation, and deflation of the lungs, may show a marked difference in the cardiac outline. Fig. 4 illustrates this change. If this fact is lost sight of it is easy to draw false conclusions as to the efficacy of exercises and baths in causing surprisingly sudden and improbable alterations in the area of cardiac dullness. We have shown elsewhere the effect of change of bodily position upon the heart.⁵

Furthermore, it should be remembered that the heart rests upon the diaphragm in close proximity to the stomach and liver, so that distention of the former or enlargement of the latter may cause a deflection of the heart to the left or right, thus giving the impression of enlargement on the side toward which it is deflected.

ANEURYSMS OF THE THORACIC AORTA. In the study of aneurysms of the thoracic aorta the orthodiagraph is of real value. With it we are enabled to reproduce diagrammatically the dilated aorta in its exact size, and thus, while making or confirming a diagnosis of the pathological condition by a fluoroscopic examination, we are able to add materially to our historical record of the case. There would seem to be no doubt of the fact that a direct inspection of the heart and great vessels by means of the fluoroscope is of far greater value than an x-ray picture. By direct inspection we can detect the pulsations of the aneurysm and thus may distinguish it, in most cases at least, from solid intrathoracic tumors; whereas, the radiographic picture would show only a shadow which might be either an aneurysm or some form of tumor or glandular enlargement. The oblique illumination is also useful in studying thoracic aneurysms.

VALVULAR LESIONS. It has long been known that certain valvular lesions have a tendency to cause dilation and hypertrophy of the various divisions of the heart, this having been proved not only by the anatomical findings after death but by percussion of the cardiac region during life. In the orthodiagraph we have an excellent instrument for making interesting and more or less valuable records of these changes in the heart's outline. We alluded to this in our previous work, but only very briefly.⁶ We have selected for illustration from our collection of diagrams of pathological conditions of the heart a few in which the lesions seemed to be sufficiently clear cut to be of value in this paper. Of course, when a number of valvular lesions coexist there can be nothing distinctive about the cardiogram. While there is no doubt that the different valvular lesions cause the heart to enlarge in a more or less characteristic

⁴ Ztsch. f. Balneologie, Klimatologie, und Kurort, Hygiene, 1909-10, ii.

⁵ Claytor and Merrill, loc. cit.

⁶ Claytor and Merrill, loc. cit.

manner, yet it must not be forgotten that this is not invariably the case. The heart that has been for any prolonged period in the state of lost compensation becomes more or less generally dilated,

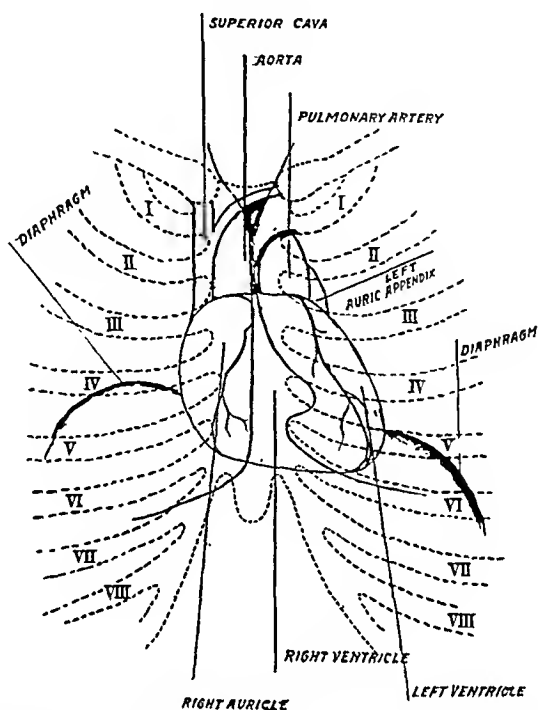


FIG. 1.—The normal heart and great vessels as seen from in front (after Moritz somewhat modified.)



FIG. 2.—Illustration of the method of outlining the heart and landmarks (heart of aortic insufficiency.)

and thus there is likely to be lost any characteristic outline which at an earlier date may have been present.

DESCRIPTION OF ORTHODIAGRAMS. Fig. 1, a somewhat modified diagram after Moritz,⁷ shows the normal heart and great vessels as seen from in front.

⁷ Strassburg Med. Zeit., August, 1907.

Fig. 2 shows how the neck, shoulders, body, diaphragm and heart are outlined by dots (the heart of aortic insufficiency).

Fig. 3 shows a completed diagram of a normal heart: "right auricular curve" (1); "curve of the great vessels" (2); aortic curve (3);

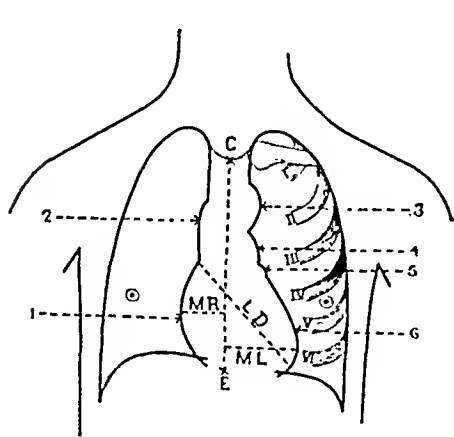


FIG. 3.—Orthodiagram of the normal heart.

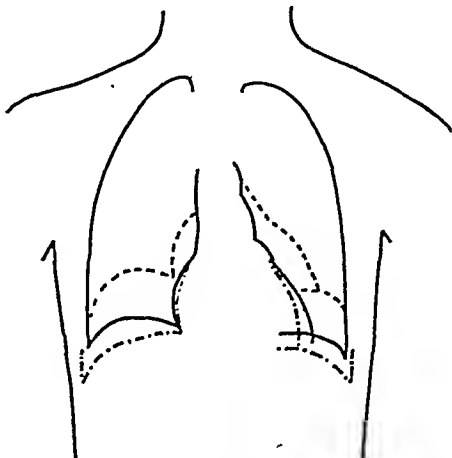


FIG. 4.—Alterations in cardiac outline due to changes in the position of the diaphragm.

pulmonary curve (4); left auricular curve (5); left ventricular curve (6); together with the lines upon which the size of the heart is estimated (L. D., longitudinal diameter; T. D., transverse diameter, the sum of M. R. and M. L.)

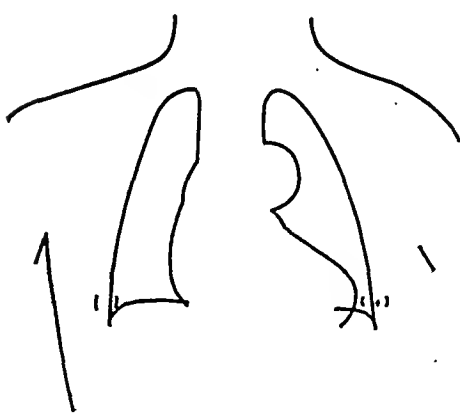


FIG. 5.—Aortic insufficiency—possibly also thoracic aneurysm.

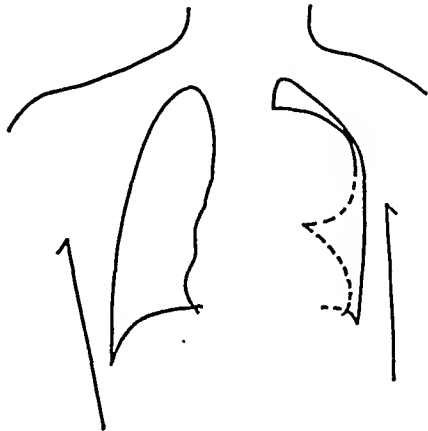


FIG. 6.—Aneurysm of the aorta.

Fig. 4. The continuous line shows the diagram of the heart and diaphragm during quiet respiration. The broken line shows the same during extreme expiration, while the diagram formed by the dots and dashes is taken during deep inspiration. This figure

clearly indicates the remarkable mobility of the heart and, one might say, flexibility of its walls, thus accounting for many mistaken ideas as to the sudden changes in the actual size of the organ as demonstrated by percussion.

Fig. 5 is the heart of a man, aged sixty-six years, who presented the typical signs of an aortic insufficiency. The chief point of interest was as to whether the very marked aortic curve was due to a true aneurysm or only to the dilatation of the arch of the aorta so often seen in aortic insufficiency. Since our notice was called by Dr. F. H. Williams to the remarkably wide excursion of the aortic pulsation in cases of insufficiency of the aortic valve we have frequently noted its occurrence.

Fig. 6 is from a patient with a very large aneurysm of the arch and descending limb of the aorta. Because of the congested and possibly infiltrated condition of the left lung as the result of pressure it was only possible to outline the upper portion of the enlargement. The broken line indicates the probable position of the lower part of the dilatation and of the heart.

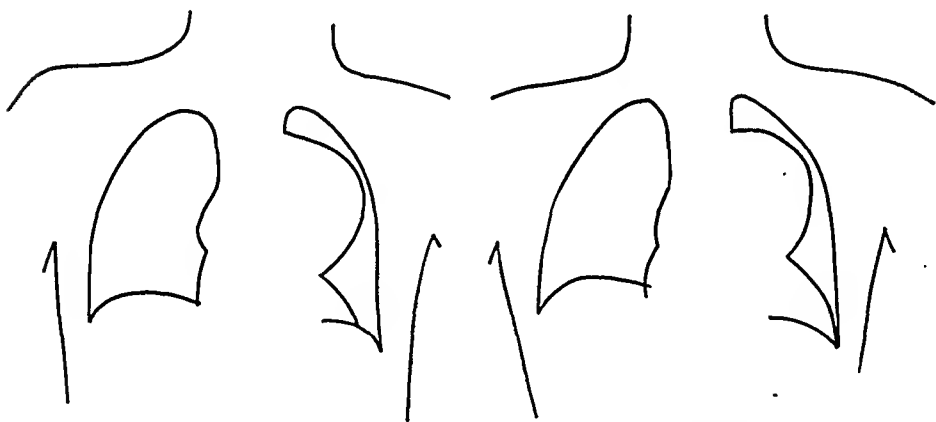


FIG. 7.—Diagram of a thoracic aneurysm.

FIG. 8.—The same case three months later.

Figs. 7 and 8 are two diagrams of the same aneurysm, the second having been taken about three months after the first. There had been practically no change, the apparent difference in the size of the heart being due to the fact that the left side of the diaphragm was taken in a lower position in one figure than in the other.

Figs. 9 and 10 are two of our most instructive diagrams, Fig. 9 having been taken sixteen months later than Fig. 10. It may be clearly seen that the aneurysm which is depicted has markedly increased both to the right and to the left. The heart has also enlarged. The prognostic value of the orthodiagraph is here demonstrated. (This patient was seen through the courtesy of Dr. R. W. Baker.)

In a study of changes produced in the heart's silhouette by the various valvular lesions there are several things to be considered:

namely, the age of the patient—the heart in the aged shows a tendency to enlarge and to assume a more oblique position in the chest; the presence of other causes for cardiac hypertrophy, such as arteriosclerosis, chronic nephritis, etc.; the appearance may also

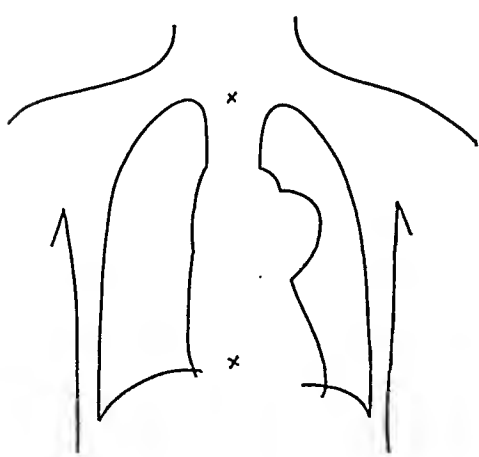


FIG. 9.—Diagram of a thoracic aneurysm.

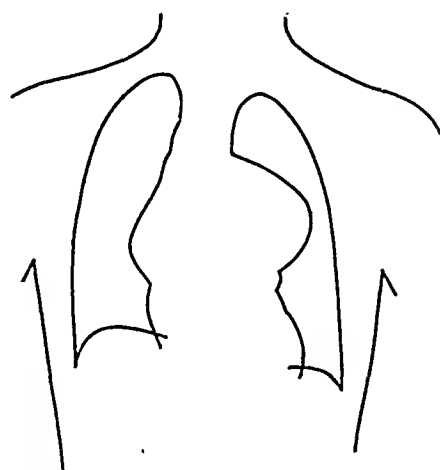


FIG. 10.—The same case—sixteen months later.

vary depending upon whether the valvular lesion be single, double, or multiple, or whether there has ever been any actual loss of compensation. All of these points, and others not enumerated, are of considerable importance in drawing conclusions concerning a diagram.

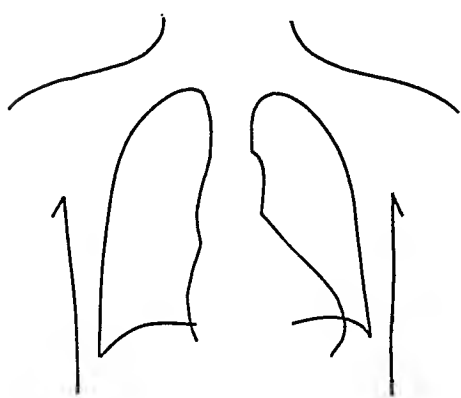


FIG. 11.—Mitral insufficiency.

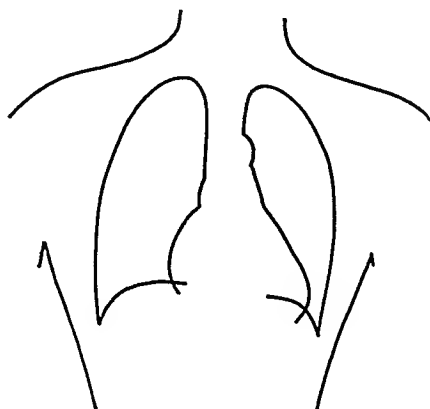


FIG. 12.—Mitral stenosis, well compensated.

Fig. 11 is a diagram of the heart of a man, aged thirty-six years, representing the physical signs of mitral insufficiency with good compensation. The organ is in the vertical position. The pulmonary and left auricular curves, while indistinguishable in this instance,

are enlarged, making the cardiogram rise toward the left axilla. The left ventricular curve is only moderately increased.

Fig. 12 shows the outline of a case of compensated mitral stenosis in a woman, aged thirty-seven years. The chief characteristics are the decidedly vertical position in the chest, the rather full right auricular

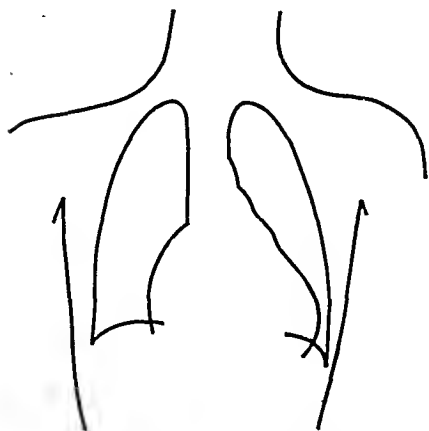


FIG. 13.—Mitral stenosis after prolonged loss of compensation.

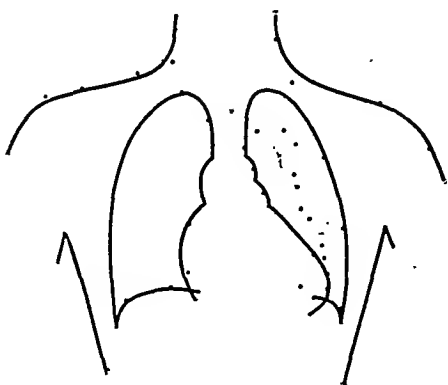


FIG. 14.—Mitral insufficiency and stenosis.

and pulmonary curves, but most striking of all the increase in size of the left auricular curve with the relatively small left ventricular curve, which is just what would be expected because of the fact that there is seldom much increase in the size of the left ventricle in pure mitral stenosis.

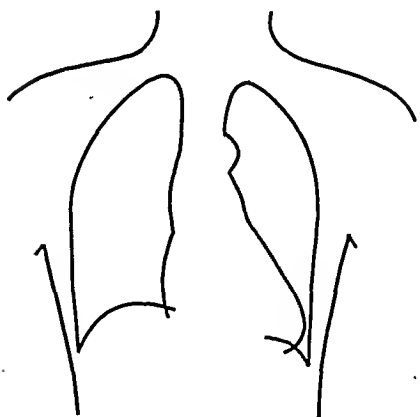


FIG. 15.—Double mitral lesion.

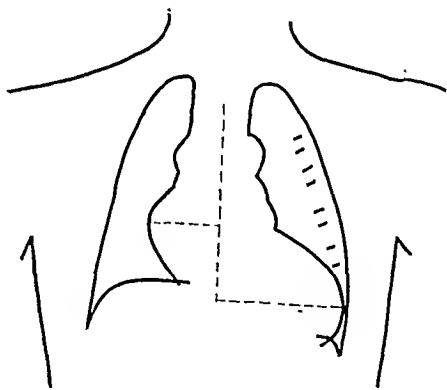


FIG. 16.—Mitral and aortic insufficiency.

Fig. 13 shows the heart of a woman, aged twenty-five years, with a pure mitral stenosis which, however, has passed through a long period of broken compensation. The whole heart is greatly enlarged. The striking features are the bulging right auricular, pulmonary, and left auricular curves.

The outline of the heart with a double lesion may vary, we believe, with the priority of the affection. Thus, in the case of the mitral valve if the insufficiency be the primary trouble the left ventricular curve will be much more pronounced than when the stenosis has been primary.

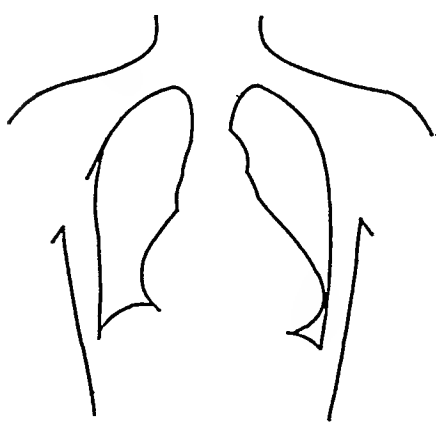


FIG. 17.—Mitral and aortic insufficiency, the mitral probably the more important.

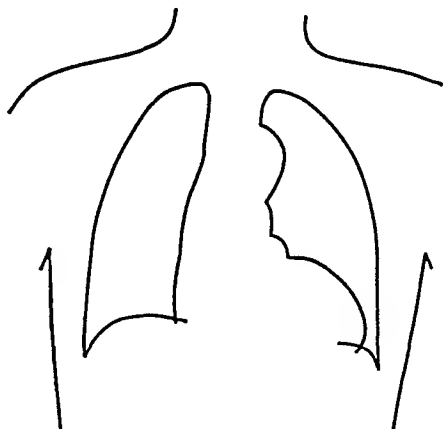


FIG. 18.—Double aortic lesion.

Fig. 14 is of a heart presenting a double mitral lesion in which the stenosis is probably the more important, while in Fig. 15 the insufficiency was probably the prior lesion. In both, the right vascular, pulmonary, and left auricular curves are bulging, but in

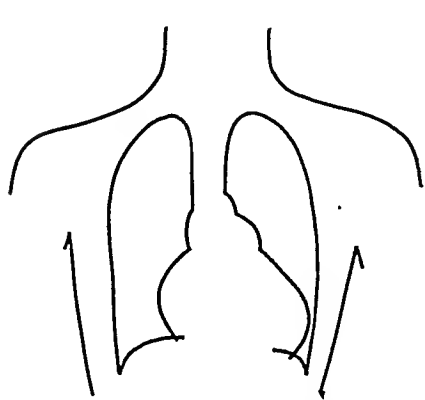


FIG. 19.—Congenital hypoplasia of the aorta.

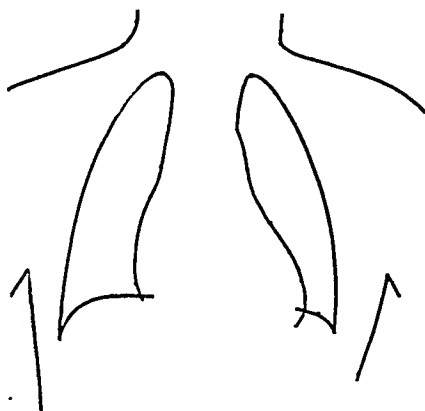


FIG. 20.—From a case of general arteriosclerosis.

Fig. 15 the left ventricle shows greater hypertrophy. In Fig. 2 we have an excellent example of a pure aortic insufficiency in a man, aged thirty-five years. Both the longitudinal and transverse diameters are considerably increased. The heart is obliquely situated, and is foot-shaped. With this lesion the right vascular and aortic curves

are especially marked because of the dilated condition of the aorta which is so commonly observed. In aortic stenosis the shape of the heart is said to be much the same, but there is no dilatation of the aorta.

Fig. 16 is an example of a combined aortic and mitral insufficiency in a man, aged fifty years. In this instance the aortic was the primary lesion, having preceded the mitral by several years. The hypertrophy and dilatation were enormous, all the curves being greatly exaggerated.

Fig. 17 represents the same lesions in a woman, aged forty years. From the shape of this heart the mitral lesion probably antedated or was more important than the aortic.

Fig. 18 is from a man, aged sixty-six years, with a double aortic murmur. Upon the right side of the heart it may be seen that the right auricular and right vascular curves form a continuous and almost straight line, and this we believe is due to the fact that the pericardium is outlined instead of the heart itself. The heart is of the aortic type.

Fig. 19 is from a young woman who has given evidences from childhood of a moderate degree of cardiac insufficiency. There is a harsh systolic murmur heard over the entire precordium with greatest intensity in the second and third interspaces to the left of the sternum. The heart is rather uniformly enlarged, but the point of interest is the great size of the pulmonary curve, which, as may be seen, is relatively much larger than the aortic. The diagnosis of congenital hypoplasia of the aorta was made some years ago by a very careful observer, and this diagram would appear to support this diagnosis.

Fig. 20 is from a man, aged forty-five years, six feet and one-half inches in height, and weighing 175 pounds. There was a general arteriofibrosis, with high systolic blood pressure, but perfectly normal urine. There were no endocardial murmurs, and the heart would appear to be uniformly enlarged.

It seems unnecessary to multiply diagrams. From those shown it may be seen that the orthodiagraph is of real value to the clinician, and that as it becomes more commonly used we may be able to formulate some useful facts which as yet it is unwise to attempt. The instrument is by no means necessary in all cases, but may be an aid to diagnosis in many more or less obscure pathological conditions of the heart and aorta.

THE ETIOLOGY OF SUBACUTE INFECTIVE ENDOCARDITIS.¹

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DURING the last eight years we have had the unusual opportunity of making studies in 43 cases of subacute infective endocarditis. Some of these cases were seen in the wards of Mount Sinai Hospital, with the kind permission and coöperation of the attending physicians, Drs. Brill, Koplik, Manges, Meyer, and Rudisih. Many of the cases were seen in the private practice of ourselves or of other physicians who kindly called us in to make bacteriological studies, or to see the cases clinically. In 36 of the 43 cases blood cultures were made during life. Of the 43 cases, 29 were seen since 1906; this shows that the disease is now being more frequently recognized. In many of the cases we were enabled to make not only bacteriological but also clinical, therapeutic, and pathological studies. The details of these investigations, together with a discussion of the literature of the disease and the question of terminology, we shall reserve for a subsequent comprehensive presentation.

The duration of our cases varied from four months to a year or a year and a half. The longer cases may be grouped as the chronic type. Although the cases differed from one another in certain respects, the picture as a whole is a characteristic one, resembling that described by other writers on the disease.² In nearly all the cases the disease began insidiously; it was often difficult to determine with any degree of accuracy the date of onset. Fever was present in all the cases, at times quite low, at times (usually later in the disease) high and intermittent, with or without chills. In the cases in which splenic infarctions dominated the clinical picture the temperatures were usually high and markedly intermittent. Malaise and gastric or intestinal disturbances were frequently present; sweats occurred in nearly all the cases, usually during the latter part of the disease. In all of the cases there was progressive weakness and emaciation. The spleen was nearly always enlarged and palpable. Pains were quite constant. In some cases they were localized in

¹ Read at a meeting of the Association of American Physicians, Washington, D. C., May 3 and 4, 1910.

² Lenhartz, *Die septischen Erkrankungen*, Hoelder, Vienna, 1903; Litten, *Zstehr. f. klin. Med.*, 1881, xl; *Berl. klin. Woch.*, 1899, No. 28; *Verhandl. d. Cong. f. Inn. Med.*, 1900; Osler, *Quart. Jour. Med.*, 1909, ii, 219; Horder, *Quart. Jour. Med.*, 1909, ii, 289; Rosenow, *Jour. Infect. Dis.*, 1909, vi, 224; Billings, *Arch. Int. Med.*, 1909, iv, 409; Schottmueller, *Munch. med. Woch.*, 1909, lvii, 617.

the bones, joints or muscles; in others they seemed to be neural in origin. Mild joint swellings were not infrequently met with. At times the pains were due to the development of embolic aneurysms,³ which are so apt to develop in the disease under discussion. The painful erythematous cutaneous nodules, the diagnostic value of which has been particularly emphasized by Osler, seem to be pathognomonic. A symptom to which no attention has been paid is the tenderness of the lower part of the sternum that was present in nearly all of our cases. It is present at times even before the anemia is sufficiently developed to account for it.

The progressive anemia of the disease and the color of the face (waxy, dirty waxy, or whitish) are noteworthy features. The leucocytes were not usually increased to any degree except when the disease was advanced and various secondary lesions occurred. Petechiæ occurred in nearly all of the cases at some time or other. At times they were abundant, and were scattered over a large part of the body. At other times they were few in number and but few crops appeared. Hematuria, microscopic or macroscopic, occurred quite commonly.

None of the cases that we succeeded in following recovered. We performed autopsies in 19 cases. In 15 of these blood cultures had been made during life; in 1 of these 15 cases the cultures were all negative (5 mere made).⁴ The process was always engrafted on a previously diseased valve, and the history nearly always pointed to earlier attacks of rheumatism. The lesion was vegetative in type, not ulcerative. When the aortic valve was involved there was a marked tendency for the process to spread down and attack the wall of the ventricle, the ventricular surface of the aortic flap of the mitral valve, and the chordæ tendineæ. If the mitral valve was involved, the process spread over the wall of the left auricle and involved the chordæ tendineæ. The latter were often torn. At times the auricular lesion was much more extensive than the valvular lesion. This accounts for the fact that in many cases the cardiac auscultatory phenomena change so little during the course of the disease.

The distribution of the lesions was as follows: In 10 cases the mitral valve alone was implicated; in all of these there was auricular endocarditis. In 2 cases the aortic valve alone was involved. Both valves were affected 7 times. In 6 of these auricular endocarditis was present (in one no note is recorded as to whether there was such a lesion or not). It is evident that a lesion of the

³ John Hopkins Hosp. Bull., 1906, xvii, 223.

⁴ After this patient left Mount Sinai Hospital he was admitted to the Sydenham Hospital. Several blood cultures made there were also negative. A postmortem examination was made, and the lesions typical of subacute infective endocarditis were found. The vegetations showing masses of streptococci; no cultures were made. We are indebted to Dr. B. S. Oppenheimer for these facts.

auricle practically always occurs when the mitral valve is involved. In one case, that of a man dying of decompensation and chronic nephritis, changes were found that indicate that the lesions in subacute infective endocarditis may heal, at least to a certain extent. The characteristic lesions were found on the auricular wall, undergoing organization; the chordæ tendinæ showed the usual lesions, undergoing fibrous and calcareous changes. There were no bacteria in the blood nor in the vegetations. As a rule, the vegetations in this disease contain innumerable organisms.⁵

As stated above, we have encountered 43 cases which were characterized by the clinical course and the pathological findings just detailed, and in 36 of these cases blood cultures were made.⁶ Altogether 103 examinations were undertaken.⁷ In 35 cases we found the atypical cocci which we shall presently describe. In one case we found the influenza bacillus. In this case the clinical course and pathological findings were essentially the same as in the large group in which cocci were found. Even the typical, painful, erythematous nodules were present. The blood-plates in the case were remarkable in that the hemoglobin was attracted, as it were, to the colonies. For the colonies became deep red after a few days, and the rest of the plate became lighter in color.

The number of colonies found in this case was at first 53 to the cubic centimeter; later it rose to 94. In cases due to infection by the atypical cocci there was a great variation in the number of organisms present. In one case only two colonies were found in 25 cubic centimeters of blood. The largest number was 500 in a cubic centimeter. It is noteworthy that in a few cases it was found necessary to make several cultures before a positive result was obtained. And we encountered one case (mentioned above) in which five cultures made in many media were all negative. Drs. Fried and Sophian, of our laboratory staff, made a microscopic study of the blood in a number of cases,⁸ and found that this gave no definite information in cases which at the time gave negative cultural results.

We were recently surprised to find that it is at times necessary to observe the plates for six days. We had usually kept them for five days. The probability is that this accounts for some of the negative results. As a rule, the organisms can be found after forty-eight hours, at times after twenty-four hours. It is advisable to use both fluid and solid media.⁹ Media containing glucose at times gave

⁵ The lesions in the spleen and kidneys are also quite characteristic, but will not now be discussed.

⁶ Two cases are still under observation.

⁷ We do not include a few cases which were studied bacteriologically after death only, because ordinary bacteria may cause a secondary or terminal infection in cases due to the atypical cocci and crowd the latter out.

⁸ These results will be published later. They constitute a part of a large study of the blood or bacteria by direct microscopic examination.

⁹ Libman, loc. cit., p. 216.

a better result. Serum-glucose-agar was often found to be the optimum medium.

Before proceeding to describe the cocci found in our cases, it is necessary to discuss briefly the character of pneumococci and streptococci, which they resemble. Based on the studies of Dr. Buerger,¹⁰ we had for several years made use of certain criteria for the identification of these organisms. When Neufeld's¹¹ publication appeared claiming that pneumococci and *Streptococcus mucosus* were dissolved by bile, and that streptococci were resistant, Dr. J. Rosenthal and one of the writers (Libman) made a study to determine whether this held true according to our classification.¹² We found that all organisms which we identified as pneumococci or as *Streptococcus mucosus* were promptly dissolved by bile, and that those identified as streptococci were not. We included in our study a careful observation of the growth of the organisms on the surface of blood plates, the method of differentiation first suggested by Schottmueller.¹³

The earlier studies made in our laboratory by Dr. Buerger had given us the following data. Pneumococci often possess a capsule the morphology of which is diagnostic.¹⁴ At times the capsule degenerates and resembles the one sometimes found on streptococci, or the capsule may be lost. *Streptococcus mucosus* also possesses a diagnostic capsule, which, however, may undergo the same changes as the pneumococcus type capsule. Ordinary streptococci often have capsules, but these are not diagnostic, as the degeneration of the capsules of pneumococci or of *Streptococcus mucosus* may produce the same form. The pneumococcus ferments inulin, as claimed by Hiss,¹⁵ but not in every generation. *Streptococcus mucosus* always ferments inulin,¹⁶ ordinary streptococci rarely do so. Pneumococci and *Streptococcus mucosus* were rarely found to throw out a precipitate in glucose-serum-agar,¹⁷ streptococci always do.¹⁸ The pneumococcus often grows in a typical fashion on the surface of serum-agar or glucose-serum-agar (so-called pneumococcus ring colonies¹⁹). At times pneumococci or streptococci grow mucoid on the media, but otherwise differ in no way from the ordi-

¹⁰ Jour. Exp. Med., vii.

¹¹ Ztschr. f. Hyg. u. Infectiousk., 1900, xxxiv, 454.

¹² Paper presented at the meeting of the Association of American Pathologists and Bacteriologists in 1903; not yet published.

¹³ Münch. med. Woch., May 19, 1903, 1.

¹⁴ Buerger, Centralbl. f. Bakteriöl., Orig., xxxix, 20, 216 and 346; Jour. Infect. Dis., 1907, iv, 426; Mount Sinai Hosp. Rep., 1907, v.

¹⁵ Jour. Exp. Med., vi, 317, and vii, 556; Centralbl. f. Bakteriöl., 1902, xxxi, 302.

¹⁶ Buerger, Centralbl. f. Bakteriöl., 1906, xli, 314.

¹⁷ In this test, 0.5 per cent. glucose is used, and an ascitic serum having a specific gravity of 1015 or more. The time of observation is two days. Dr. Buerger's positive results were obtained after two days had elapsed.

¹⁸ Libman, Jour. Med. Research, 1901, i, 89.

¹⁹ Buerger, Centralbl. f. Bakteriöl., 1905, xxxix, 20.

nary forms. These organisms are called mucoid pneumococci and mucoid streptococci.

In the course of the studies made by Dr. Rosenthal and ourselves, we investigated 19 strains of pneumococci, 69 of streptococci, and 12 of *Streptococcus mucosus*. The organisms were isolated from local infections in various parts of the body. Our investigations led to the following conclusions:

1. The type capsule of the pneumococcus and that of *Streptococcus mucosus*, as described by Buerger, are diagnostic. All organisms presenting such capsules are dissolved by bile.

2. Solution by bile is diagnostic of the pneumococcus and *Streptococcus mucosus*. This latter organism is easily distinguishable by its type of capsule and certain other features.²⁰

3. The absence of precipitation speaks almost absolutely against an organism being a streptococcus.

4. The fermentation of inulin is not of pathognomonic value. While it is a feature of the pneumococcus, the property may be absent, and, furthermore, streptococci occasionally give a positive result.

5. The ring colonies are diagnostic of the pneumococcus.

6. The growth on blood plates²¹ gives the following results of value: (a) A definite large (two to three millimeters in diameter), perfectly clear zone (so-called hemolytic zone) about a colony is diagnostic of streptococci if it is found to persist in several generations. Incomplete clearing is of no diagnostic value, nor is a linear clearing. (b) Pneumococci always grow green²² (once the growth was brownish green). An organism not producing a green color always proved on further study not to be a pneumococcus.

The conclusions we arrived at in the study just detailed were based on the following findings:

1. Type capsules were found on all nineteen pneumococci studied, either in the original material (pus, sputum, etc.) obtained from the patient or in cultures. All the organisms were dissolved by bile. Type capsules were found on all the strains of *Streptococcus mucosus*. Of 69 ordinary streptococci, 32 had capsules.

2. All of the streptococci precipitated. In one, this was slightly marked, but was intense after passage through one mouse. Of 19 pneumococci, only two precipitated; these two had been in bile (this seems to favor the development of a precipitating power) and did not precipitate in the second generation. Of twelve strains of *Streptococcus mucosus*, one precipitated for four generations, and one for two generations.

²⁰ Centralbl. f. Bacteriol., 1906, xli, 314.

²¹ In this work, besides using human-blood plates, we also made use of the blood plates made of ox blood according to the method of Bernstein and Epstein, Jour. Infect. Dis., 1906, iii, 722.

²² In our work we included, as producing green color, organisms the colonies of which either were green or were surrounded by a green zone.

3. Of nineteen pneumococci, all fermented inulin except two (in two others the result was very slight). With these two a slight result was obtained by passage through two mice. The strains of *Streptococcus mucosus* all fermented rapidly. Of the 69 streptococci, 2 fermented inulin, one lost the property in the second generation and also after passage through one mouse. The other lost the property after passage through two mice.

4. On blood media, all but 11 of the streptococci grew in fine gray colonies surrounded by an absolutely clear zone²³ (as described by Schottmueller for *Streptococcus longus*). Of the 11 exceptions, 7 gave a good white, moist growth without any clear zone,²⁴ 3 grew green like the pneumococcus, and one gave only a slight almost colorless dry growth with no clearing.

All the pneumococci grew in green colonies, some with partial clearing, some with no clearing. Some colonies were green by transmitted light (not by reflected light). One produced brownish-yellow-green colonies, and one produced clear zones about the colonies in a plate made with the blood of the patient from whom the organism had been isolated, but not on other blood plates. All of the strains of *Streptococcus mucosus* produced green colonies and were mucoid in the earlier generations.²⁵

The strains of ordinary streptococci which grew white were obtained as follows: Three were from cases of otitis media and mastoiditis, one from a case of cholecystitis, one from a case of liver abscess, one was a postmortem invader.

The streptococcus which gave a slight dry growth was obtained from a skin infection. The three strains that gave green colonies were obtained as follows: One from a case of appendicitis, one from a case of otitis media, one from a specimen of sputum.

The cocci found in the cases of subacute and chronic infective endocarditis during the last few years were carefully studied along the lines we have just discussed. These organisms are all Gram-positive. They have never been found to have a capsule. They are either round, ovoid, lancet-shaped, or bacillary in form, and may be found in diplococcus form, in groups, or in chains. Every organism except one was found sooner or later to grow in chains which were often very long and convoluted. They are usually smaller than the ordinary streptococci and pneumococci, and grow more poorly, especially when first isolated. We shall not now describe their manner of growth on the ordinary laboratory media (gelatin, agar, potato, milk, etc.) because no definite diagnostic criteria are thus afforded.

²³ One of us (Libman) has pointed out that such clearing may occur in the form of concentric rings.

²⁴ These would correspond, at least in part, to the type called *Streptococcus mitior* or *viridans* by Schottmueller.

²⁵ In the paper to be published by Rosenthal and Libman, the growth of *Streptococcus mucosus* and of the pneumococcus will be described in more detail. A very interesting type of growth not hitherto noted was seen a number of times.

As will be seen from the accompanying table, these organisms fall into two groups, one of which ferments inulin and the other not.²⁶ The former comprises about one-third of the organisms. They all produce a precipitate in serum-glucose-agar and are all resistant to the action of bile.

	Pneumococcus.	Streptococcus.	Streptococcus inucosus.	Endocarditis coeci.	
				A	B
Capsule	1. Diagnostic or 2. Degenerate or 3. Not present	1. Non-diagnostic or 2. Not present	1. Diagnostic or 2. Degenerate or 3. Not present	Not present	Not present
Gram	+	+	+	+	+
Blood plates	Green; no clear zone	1. Gray; clear zone 2. Green; no clear zone 3. Moist, good white growth, or slight dry whitish growth; no clear zone.	Green; usually mucoid; no clear zone	1. Green; no clear zone. 2. Moist good white growth, or slight dry whitish growth; no clear zone	
Inulin fer- mentation	+	—	+	+	—
Precipita- tion.	(occasionally—) — (rarely +)	(rarely +) +	— (rarely +)	+	+
Solution by bile	+	—	+	—	—

Note: Ring colonies of the pneumococcus are diagnostic.

In describing the growth of these coeci on blood plates a distinction must be drawn between the phenomena seen in the plates made with the patient's blood, and in subsequent inoculations on plates made with other blood. In the former, a definite clear zone is sometimes, although rarely, seen. It usually takes two to four days to develop. (Ordinary streptococci that produce a clear zone do it more rapidly.) In subsequent transplantations this is lost. The colonies in the original plates are usually white in color, with or without a green or an opaque zone about them. The deeper colonies are white or opaque. In subsequent cultures on blood plates, three types of growth are seen. There may be a production of green pigment, there may be a moist white growth, or a dry almost colorless very slight growth.

Before finally coming to the question of the grouping of these organisms, it is essential to draw attention to the remarkable changes which pneumococci (and to a much less extent streptococci) may

²⁶ A study of the growth on other carbohydrates gave no useful differential features except when raffinose was used. The organisms can probably be further subdivided by a study on raffinose media. The inulin and raffinose fermentation generally go hand in hand. Twice we found organisms that fermented raffinose and not inulin.

undergo in the body, especially in the blood current. Studies made by Drs. Buerger and Ryttenberg²⁷ demonstrated that pneumococci may lose their type capsules, may lose the property of fermenting inulin, and may acquire the power of precipitation.²⁸ One of us had previously shown that they could acquire temporarily the property of producing a clear zone about the colonies.²⁹

By inoculation of such cultures into mice, the method usually employed in an attempt to bring back the feature of altered pneumococci, some organisms could be converted into typical pneumococci. However, if such organisms were first kept in media for a long period, and then inoculated into mice, the pneumococcus character could no longer be developed. As regards streptococci, we have already stated that in the work done with Dr. Rosenthal, we found two that fermented inulin, and lost the property after passage through mice. We did not find any streptococci that lost the power of precipitation, and the streptococci that produced clear zones about the colonies retained this property indefinitely.

It will now be of interest to compare the endocarditis cocci with pneumococci and streptococci. Except that they are smaller and grow more poorly (unimportant points when it comes to a question of classification), the group that does not ferment inulin resembles the type of streptococci which produce no zones of clearing in blood plates. Of course, the real relationship of these streptococci to the ordinary streptococci that produce a clear zone on blood plates has not been definitely determined. The inulin fermenting group might be considered to be a separate type, or might be regarded as being the same as the others except that they acquired the property of fermenting inulin in the body and permanently retained the property.³⁰ But we have no proof, as yet, that this may occur.

At first sight these organisms, especially those that do not ferment inulin, would appear to be far removed from pneumococci. But we have seen that pneumococci may lose their capsules, may lose the property of fermenting inulin, and may acquire the property of precipitation. Many of the organisms grow on blood plates like pneumococci. But we have not hitherto met with pneumococci which, when isolated from the blood, were resistant to the action of bile. If we should meet with such pneumococci, we could more easily suspect that the organisms under discussion are altered pneumococci. Possibly they represent more than one type of organism. We believe it would be best not to consider these organisms changed

²⁷ Jour. Infect. Dis., 1907, iv, 609.

²⁸ In the study made by Buerger and Ryttenberg, a study with blood plates was not systematically made. Nor were bile tests performed, the method not yet having been introduced.

²⁹ Libman Johns Hopkins Hosp. Bull., 1906, xvii, 218; Trans. Path. Soc., New York, December, 1905.

³⁰ There was no relationship found between the type of growth on blood media and the occurrence of inulin fermentation.

pneumococci until one succeeds in having them acquire the typical pneumococcus features.

The features of the endocarditis cocci have remained constant in subinoculations carried over a long period of time (in some instances as long as eighteen months). Every organism that fermented inulin still does so. After repeated animal inoculations (mice, rabbits) no change in the important characteristics has been demonstrated. Capsules have never been developed. We have made studies of the agglutinative power of sera from patients and of sera of animals immunized by repeated injections of the cocci, but we have thus far not found any agglutination of pneumococci or streptococci.³¹ Studies made by Dr. Fried of the opsonic power of patients or of immunized animals have given no definite results. Nor have the studies made up to the present time by Dr. Kaliski and Dr. A. Sophian by means of complement fixation tests.³²

We might add here that the organisms are not, as a rule, very pathogenic for animals. In mice we have sometimes produced peritonitis by intraperitoneal inoculations. In rabbits we have succeeded in producing peritonitis, and several times have produced endocarditis. In one instance the vegetations that were produced almost blocked the aortic orifice. Endocarditis resulted from our experiments in a much smaller proportion of the inoculations than in those of Rosenow.³³ This held true even after we adopted the same methods as were used in the work of this observer.

Let us now glance at the results obtained by other observers in cases of subacute infective endocarditis, in order to ascertain what organisms they found and whether any of the organisms were the same as those which we encountered. An accurate comparison is not possible, because no two authors have made use of the same methods in studying the organisms.

Lenhartz,³⁴ in 16 cases, found streptococci 13 times, a staphylococcus, a pneumococcus, and a gonococcus, each once. He says that in 10 of the 13 streptococcus cases the organism was small. He calls it "*Streptococcus parvus*." No further characteristics are given. We believe that some of his organisms must be the same as some of ours because they are found in the blood in the same type of disease.

Osler³⁵ describes 10 cases, in 6 of which blood cultures were made. Three of these gave a negative result, one revealed a streptococcus and one a staphylococcus.

Horder³⁶ in a very extensive and thorough study of various forms of infective endocarditis, describes 13 cases, from 9 of which he isolated streptococci, and from 4, influenza bacilli. He identifies

³¹ These studies were carried on in association with Dr. A. Sophian.

³² All these investigations will be further prosecuted, as only positive results are of value.

³³ Loc. cit.

³⁴ Loc. cit.

³⁵ Loc. cit.

³⁶ Loc. cit.

these streptococci with "*Streptococcus salivarius*" and "*Streptococcus fecalis*," two of five groups into which Andrewes and he³⁷ had classified streptococci (the other three groups are *Streptococcus pyogenes*, *Streptococcus anginosus*, and the pneumococcus). This classification is based mainly on the differences in the power of different streptococci to ferment various carbohydrates. But some earlier work done in our laboratory³⁸ and some recent studies on this subject by Dr. Sophian and ourselves indicate that the classification of these authors can not be adopted. Whether Horder's organisms are the same as ours it is not possible to say, because the methods of study used by him and by us differ. Considering that the clinical course was the same as in our cases, the organisms may very well have been identical. It is of interest in connection with our results to note that he found not only organisms classed as streptococci, but also influenza bacilli in the blood of his cases.

Rosenow³⁹ in a contribution to this subject replete with valuable bacteriological data, to only a few of which we can now refer, states that he found pneumococci in all the cases that he studied. "When the organisms were first isolated in broth they grew in clumps and produced a diffuse turbidity slowly, and upon agar slants the colonies grew more or less tightly to the surface. The stained specimens gave diplococcus forms and chains. The chain formation as well as the property of growing in clumps in broth and of adhering tightly to the surface of blood-agar slants disappeared after cultivation for a variable period. . . . By cultivation on artificial media all the strains change gradually into typical lanceolate diplococci, often capsulated, growing as typical pneumococci in broth and on blood-agar slants. On animal inoculations this modification often occurred abruptly." The agglutination and opsonic studies of Rosenow do suggest a relationship of his organisms to pneumococci, but until the organisms are shown to have definite pneumococcus character, they cannot be surely classed as pneumococci.

Through the kindness of Dr. Rosenow we were enabled to study five of his organisms (Nos. 292, 293, 362, 409, 413). We have not yet finished a comparative study of his organisms and ours. Only one of the organisms now produces a green color on blood plates, and that is very slight. One organism (409) ferments inulin regularly; all of the organisms are insoluble in bile. Capsules can not be demonstrated by us. As regards chain production (on which we are not willing to lay any great stress in diagnosis), it could be observed in the growth of all the organisms in fluid media. Three of the organisms precipitate markedly, two slightly. The organism that precipitates actively (409) is also the inulin fermenter.

³⁷ Lancet, 1906, lxxxiv, 708; see also Gordon, Lancet, 1905, lxxxiii, 1400.

³⁸ Buerger: Jour. Exp. Med., 1907, xix, 428.

³⁹ Loc. cit.

Schottmueller⁴⁰ in a recent publication, describes under the name "endocarditis lenta," the clinical features of subacute infective endocarditis. He cites 5 cases, in the blood of all of which he found the organism which he calls "*Streptococcus mitior*," or "*Streptococcus viridans*," because the colonies are those of a poorly growing organism and because they produce a green pigment on blood plates.

It will be remembered that Schottmueller classed the streptococci (apart from *Streptococcus mucosus*) into two groups according to the manner of their growth on blood plates and in blood bouillon.⁴¹ The one type is "*Streptococcus longus*," which grows in fine gray colonies and produces a marked clearing of the media; in blood bouillon it produces a carmine or Burgundy red color. The other, *Streptococcus mitior* or *viridans*, which grows slowly, develops fine gray or black-green colonies, and produces no clearing; in blood bouillon it produces a brownish-red discoloration. No data are given as to inulin fermentation, precipitation, or the reaction with bile, three of the criteria which we consider of importance. It is, of course, very likely that Schottmueller's organisms are the same as ours. He believes that the organism is specific for subacute infective endocarditis. With this conclusion we cannot agree, as we have also found influenza bacilli in the blood in one such case, and Horder described four such cases.

We have shown the difficulties that are encountered in an attempt properly to classify the organism which we have met in our cases. We have also shown that organisms which are practically the same as the group which does not ferment inulin have been found by us in local infections of various kinds. The important point to be brought out is that up to the present time whenever we have found the organisms which we have usually called endocarditis cocci par excellence (or attenuated streptococci of endocarditis) there was always present an infection of the endocardium. In no other disease have we found these organisms in the blood current. They, therefore, seem to have diagnostic import.⁴²

Our studies on the bacteriology of the blood now comprise over 3000 blood cultures, made in the last twelve years. Our attention was first drawn to the fine colonies of the endocarditis cocci by Dr. M. Gershel, then an interne, in 1902. In the following year Schottmueller drew attention, in the publication already cited, to his "*Streptococcus mitior*." Since 1902 we have made 2750 blood cultures. Many cases of acute endocarditis were studied in which ordinary streptococci, staphylococci, pneumococci, and the

⁴⁰ Loc. cit.

⁴¹ Schottmueller also describes differences in the manner of growth in milk and bouillon; but, as stated before, these phenomena cannot be depended upon for definite differentiation of organisms in the *streptococcus-pneumococcus* group.

⁴² The accurate characterization of these organisms will be of value in studying the source or sources of infection.

genococcus were found. But these organisms have not thus far been encountered in any blood culture made in the type of endocarditis to which this paper is devoted. Some of these cases present such a typical symptom complex that a clinical diagnosis can be made with a fair degree of certainty. It may, however, be difficult to differentiate them from cases of chronic endocarditis with fever in which there is no superimposed bacterial infection of the valve, and the disease is not infrequently confused with such conditions as rheumatism, typhoid fever, tuberculosis, Banti's disease, or splenic anemia.⁴³ While the onset is usually insidious and acute phenomena do not develop for a long time (or possibly not at all), there are cases which first present themselves with a picture resembling an acute surgical condition. Under these conditions the disease has been mistaken for appendicitis (because of acute abdominal symptoms), for abscess of the spleen, or for pyelonephritis. And it has transpired that surgical measures have been adopted in such cases.

As we have already indicated we have thus far found no help in diagnosing the disease by microscopic study of the blood, by opsonic agglutination, or complement fixation tests. The absolute diagnosis must, for the present, rest on the cultural study or the blood.

SYPHILITIC FEBRILE PYLEPHLEBITIS, WITH REMARKS ON SYPHILITIC FEVER AND ABERRANT TYPES OF HEPATIC SYPHILIS.

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EPITOME. The following report concerns a case of acute pylephlebitis with high remittent, intermittent, and prolonged pyrexia, extreme emaciation, anemia, and weakness, and rapid recovery under antisyphilitic medication. The discussion of the case covers: (a) A brief consideration of the classical forms of hepatic syphilis chiefly in their relation to aberrant types of hepatic syphilis; (b) fever in visceral lues, particularly in hepatic localizations; and (c) the mimicry of septicopyemic and toxemic conditions by syphilis of the liver.

REPORT OF THE CASE. The patient, Albert B., came under observation September 13, 1908.

Personal History. Male, aged twenty-five years, single and a fruit pedler. Born in Tennessee and lived in Illinois the last five

⁴³ Schottmueller. See also Luening, *Deut. med. Woch.*, 1900, p. 1908. In one case a clinical diagnosis of tuberculous kidney was made because of the marked renal phenomena.

years. Drinks beer very moderately, but uses no whiskey. Smokes twenty to thirty cigarettes a day, and drinks two cups of coffee with each meal. Six years ago an attack of gonorrhœa, without severe symptoms or any sequels. No venereal sores of any variety.

Family History. Father died from unknown causes. Mother died twenty years ago with pulmonary tuberculosis. Brother and sister living and healthy. No other data.

Previous Illnesses. Usual diseases of childhood, including pneumonia. Seven years ago chills and fever in Tennessee, which lasted intermittently for seven weeks and were cured with quinine.

Present Trouble. September 10, after drinking water which tasted stale, he developed malaise, severe headache, high fever, pains in the back and limbs, and went to bed. In the evening nausea was followed by three attacks of vomiting. He coughed, but no more than for the last eight months, from excessive smoking. There had been no chill, sweats, loss of weight, jaundice, urinary or circulatory symptoms, etc.

Examination. The pupils and other reflexes were normal; the nutrition was good and the skin showed no œdema, sears, or eruption. Genitalia negative. The tongue was heavily coated with a moist white fur, and the pharynx was negative. The lungs gave a normal resonance and free excursion and were free of rales. The heart examination was entirely negative, and the vessels were soft. The abdomen was retracted, but not rigid, and the edge of the liver was normal, being felt clearly on deep inspiration. The splenic margin was distinctly palpable, soft in consistency and slightly sensitive.

The patient's general appearance somewhat suggested typhoid fever, but the fever curve was irregular and a severe rigor was observed on the second day, designated by the crosses on the accompanying fever chart. A blood culture taken on the first day was negative; the leukocyte count was 6400; a Widal test was entirely negative and the urine showed no diazo reaction. The sunken, lax abdomen was repeatedly explored, but only the moderate splenic intumescence was found.

Two more blood cultures and two Widal's tests were negative; the leukocyte count rose once to 11,400, but fell to 4000 on the fifth day (September 18), and the fresh and stained blood was carefully and repeatedly examined for plasmodia, but with negative results.

As indicated in the chart, the high fever elevations ceased after one week, and for six days the curve hovered just above or below normal, when suddenly, with a rigor and renewed pyrexia (September 26), the patient complained of pain over the liver, which became tender, and a massive ascites developed in the course of the day. This sudden effusion contrasted very remarkably with the abdominal retraction which had existed up to this time. With the precipitate ascites the patient vomited severely at almost hourly intervals during September 26, and the aspect of the patient was

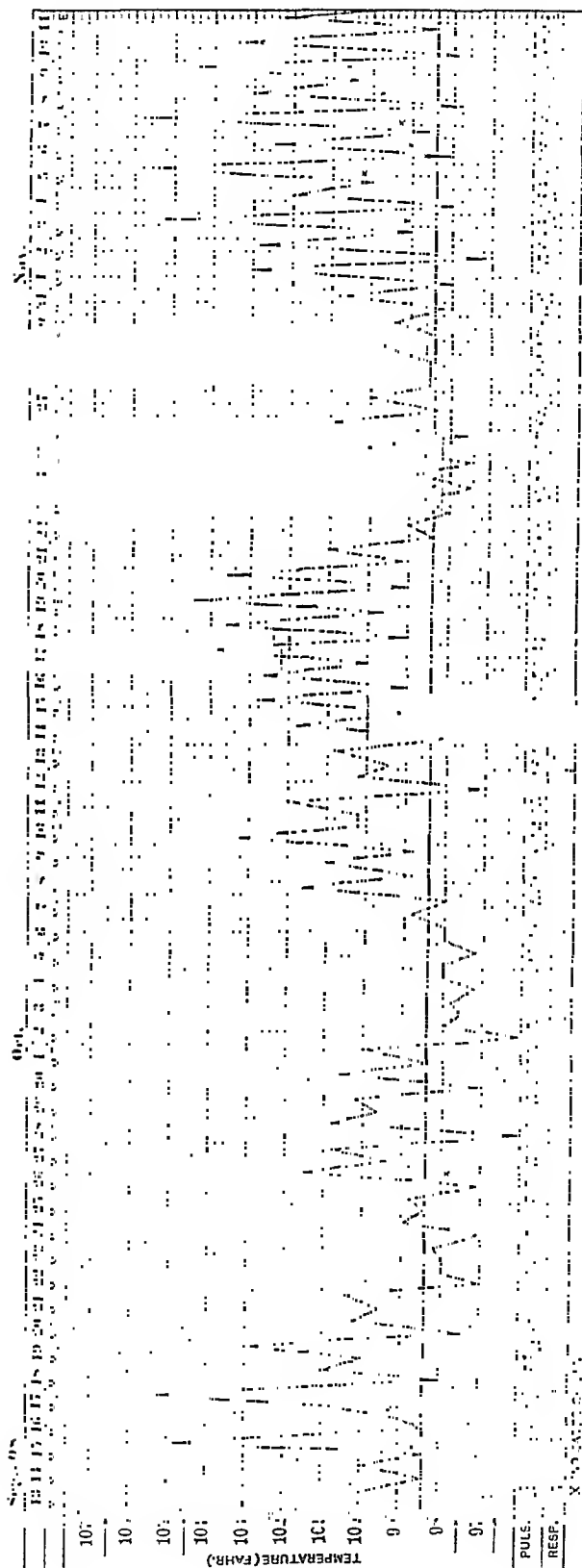
desperate, although the pulse remained slow and of fairly good quality. The possibility of a rupture of the gall-bladder, stomach, or bowel was seriously considered for the next day, and operation was advised by some who saw the patient. The leukocytes counted 6400. The urine, negative up to this time, became scanty (400 c.c.), was almost solid with albumin, and contained very many granular and hyaline casts and considerable blood.

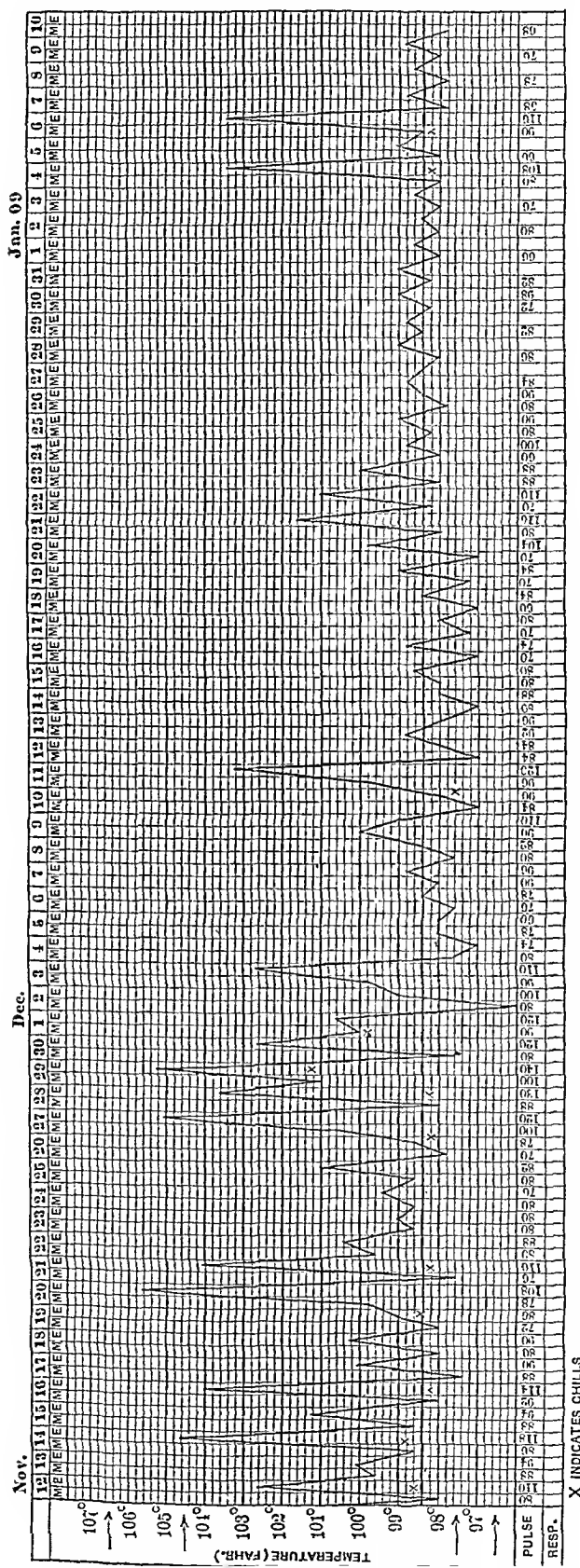
From September 26 to October 8 the fever declined, but chills and an up-and-down curve reappeared. Another Widal test and blood culture were negative. The blood showed no parasites, and an ophthalmo-tuberculin test was completely negative. The red cells counted 1,440,000, the whites 6600, and the hemoglobin was 40 to 50 per cent. The differential leukocyte count was normal, and there were no abnormalities in the stained specimen. Red and white cells, hyaline and granular casts, 3 per cent. of albumin, and a partial diazo reaction were noted in the urine.

The patient looked extremely anemic, but without the lemon tint of pernicious anemia. From October 8 to November 8 the course is best shown by the fever chart, in which a considerable remission of the fever is noted between October 20 and November 1. In the first week of November there were three febrile movements to nearly 106° , with daily variations of about 8° . What appeared to be the maximum possible distention of the abdomen increased. The blood pressure measured 135 mm. Further white counts were 8400, 6400, and 5200. Two more Widal tests and three blood cultures were negative. On November 8 a rigor lasted two hours. Vomiting and abdominal pain became more severe, and, as an after-thought of the mere possibility of lues, on November 14 the patient was put upon daily mercurial inunctions and 30 grains of potassium iodide three times daily internally.

Within three days the subjective gastric distress and abdominal pain, as well as the objective ascites, oedema, and nephritis were markedly improved. The fever, chills, and sweats were less frequent and less severe, the patient's appearance was totally different, and on November 28 the patient sat up, against orders. Point by point improvement increased, and while in December there were three, and in January two rigors and rises in temperature, the patient gained weight, color, and strength, and eighteen months later he is well and working. The Wassermann test made in January by Dr. Adolph Gehrmann was negative, but the patient then had been actively treated with antisyphilitic remedies for about two months.

The recital of such a case report is, of course, open to criticism. The disease was clearly some severe infection, but the most careful tests for its cause were negative. The brusque development of pain over the portal vein region, the sudden tenderness, and massive





Fever chart of a case of syphilitic pylethrombosis.

ascites argue for acute pylephlebitis, or some sudden compression of the portal vein. Such extreme ascites certainly was not of renal origin. Inasmuch as the liver's edge had been clearly palpated, with negative findings, an involvement of the portal vein seemed a logical inference.

Naturally a septic pylephlebitis would be considered first, and this probability fortunately saved the patient from fruitless surgical intervention. After the possibility of syphilis was entertained, the immediate response to mercury and iodides was most suggestive—if a diagnosis *ex juvantibus* is ever logical. Rosenbach¹ and others have criticised diagnoses based only upon the results of therapy, but since Klemperer² reported the cure of hepatic enlargement attended by chills and fever, some dozen similar cases in the literature of hepatic syphilis have been described by trustworthy observers³.

(A) TYPICAL AND PARTICULARLY ABERRANT TYPES OF SYPHILIS OF THE LIVER. Acquired syphilis of the liver is a common malady, yet I believe that its significance is not fully appreciated either in practice or in the literature. When one reviews the great urban and rural prevalence of syphilis, and considers that we possess absolute specifics against this infection, one is surprised that he does not oftener consider the possibility of lues in doubtful cases. In the seventeenth century hepatic syphilis was described by Botalli, Petronius, and Mercurialis, and later more fully by Bonet, Portal, and Ricard, yet Dittrich, in 1849, first fully developed the topic.

Acquired syphilis of the liver exists in two main classical forms, the syphilitic cirrhosis and hepatic gummas. It is not my purpose to describe these well-known types, except so far as they may mimic other diseases, as hepatic cancer and abscess, gastric disease, gallstones, typhoid fever, sepsis, cirrhosis of the liver, and pylephlebitis.

1. *Hepatic Gummas Resembling Cancer of the Liver.* This confusion is one of the oldest, and Oppolzer and Bochdalek mistook hepatic syphilis for cancer.

(a) Age is no criterion, although it is commonly asserted that syphilis is prone to develop in those under forty years of age, whereas cancer prevails largely after that year. In personal experience, syphilis is as common after as before the fortieth year, and it is not uncommon for gummas to form in the liver two to four decades after the initial chancre.

(b) It is maintained that in syphilis the tumors are generally smaller than in cancer, but gummas may so distend the liver that the organ occupies most of the abdominal cavity. In one very

¹ Therapie der Gegenwart, 1903-1904.

² Ibid., 1903.

³ J. Mannaberg, Wien. klin. Woch., 1902, Nos. 13 and 14; L. Lippmann, Therapie der Gegenwart, 1904; Reye, Therapie der Gegenwart, 1905; J. Israel, Deut. med. Woch., 1904, No. 14; E. G. Janeway, AMER. JOUR. MED. SCI., September, 1898, p. 251.

emaciated patient an epigastric swelling, larger than the patient's head, subsided under mercury and iodides, which therapy was suggested by the Argyll Robertson pupils. These luetic tumors generally develop more slowly than cancer, at least after they are once detected; they remain more stationary, and compression symptoms, as crowding of the enlarged liver upon the lungs and other structures, are more suggestive of cancer than of syphilis.

(c) *The edge of the liver* is rather smooth, or its anterior surface, near the suspensory ligament and near its palpable edge, is lobulated by deep, radiating furrows resulting from cicatrization and organization of the gummas.

(d) *Ascites and Icterus*. Fournier and others have remarked that the absence of ascites is a rather safe criterion for syphilis as against, *e. g.*, cancer, and this dictum doubtless holds for most cases, but cancer will be considered first in the minority of cases in which ascites is associated with icterus and emaciation, which latter, in extreme instances, may amount to cachexia. The uncommon ascites results from syphilitic cirrhosis, from amyloid degeneration, or, as a terminal event, from cardiac weakness. Syphilitic ascites is frequently combined with albuminuria.

(e) *Splenic enlargement* is exceptional and follows the compression of the portal vein by a gumma or follows amyloid degeneration of the spleen or gummas in its substance.

(f) *Pain*. Pain on movement, pain in the right shoulder, and tenderness over the liver almost invariably indicate perihepatitis, and therefore suggest syphilis. If the perihepatitis is recent, a friction rub may be heard over the liver; if it is old, adhesions to the colon or stomach and abolition of the respiratory excursion of the liver may result. Pain is important and conspicuous both in cancer and syphilis. In two cases in which large masses disappeared under specific treatment, paroxysmal pain was probably due to coincident, though poorly developed tabes. These observations are interesting in view of the fact that there is said to be a degree of antagonism between syphilis of the liver and the parasymphilitic nervous diseases, as tabes. Search for other evidences of syphilis and a history of venereal infection are important, but these considerations are purposely subordinated, as we must frequently diagnose or suspect syphilis in their absence.

(g) *Emaciation and Cachexia*. In hepatic syphilis, emaciation may attain such an extreme degree of development that carcinomatous cachexia is diagnosed without much hesitation. Clearly hepatic symptoms, such as tumors, ascites, icterus, and enlarged liver, combined with anemia, emaciation, and cachexia, which are probably due to metabolic disturbances, make differentiation impossible, except by the help of successful therapy by mercury and iodides. In a patient of Dr. William E. Morgan, there was an enormous ascites and extreme emaciation; an operation disclosed a

gummatous and lobulated liver, though previously carcinoma seemed almost certain. After the incision, specific remedies produced immediate and permanent recovery.

In just this group of cases gastro-intestinal symptoms may seem to indicate a primary cancer in the stomach or bowels. In one instance there were tenderness and pain in the pyloric region, vomiting, occult blood in the vomitus and feces, absence of free hydrochloric acid in the test meal, and cachexia; the presence of nodes in both lobes of the liver strengthened the probability of gastric cancer with secondary metastases in the liver. The history of venereal infection suggested the bare possibility of syphilis, and sublimate hypodermies and iodides wrought a complete cure. Quincke⁴ describes an instance of dilatation of the stomach, due to gummas in the mesentery, which responded, rapidly and permanently, to iodides. Inasmuch as gastro-intestinal symptoms suggest a primary neoplasm in the alimentary tract, it is profitable to note Mareuse's observation that two-thirds of the patients with hepatic gummas exhibit early digestive disturbance.

2. *Syphilitic Cirrhosis Resembling Alcoholic Cirrhosis.* There is no absolute criterion for differentiation between syphilitic and portal cirrhosis. In syphilitic induration the size of the liver is more commonly increased than decreased, even though the process is destructive rather than hyperplastic. The new-formed connective tissue follows the portal vein and its ramifications into the liver substance, the lobules of which are more invaded than in alcoholic cirrhosis. An obliterative endarteritis may augment the damage to the liver cells, which degenerate and atrophy, particularly toward the anterior border of the liver. The surface of the liver is uneven with furrows or nodules and its edge is somewhat sharper than in the ordinary form of cirrhosis. Perihepatitis is common and results in various adhesions. Icterus occurs in one-third of the cases and the attendant enlargement of the spleen develops from stasis, toxemia, or amyloid degeneration. Ascites is less common than in the alcoholic variety, develops later, and is prone to recur after tapping. A longer clinical course and fairly good nutrition are said to be characteristic, but there are many exceptions. Two greatly reduced subjects, apparently suffering from advanced cirrhosis, recovered completely under iodides.

3. *Gummatous Hepatitis Resembling Gallstones.* Riedel,⁵ particularly, has drawn attention to an important group of cases, which simulate gallstones, cholecystitis, and, if icterus is present, even resemble calculous obstruction of the common duct. Coincident temperature may further obscure the differentiation. In this type the gall-bladder is never involved alone, but there is always coin-

⁴ Deut. Archiv f. klin. Med., 1903, lxxvii.

⁵ Mitteilung aus dem Grenzgebiet, d. Med. u. Chir., 1904, xiv, 1.

cident syphilis of the liver. Riedel reported several such cases, and Trinkler⁶ found 13 reported operations in which liver gummas were found instead of some other suspected surgical disease.

(B) FEVER IN VISCERAL LUES, PARTICULARLY IN HEPATIC LOCALIZATIONS. The topic of fever in syphilis dates from Werlhof (1732), J. Frank (1821), and Yvarres (1854). Güntz was the first to record syphilitic fever taken by the thermometer, and Bäumler⁷ wrote upon the subject.

Fever in hepatic syphilis was described by Frerichs and Gerhardt, and within recent years Stauder, Mannaberg,⁸ Klemperer, Janeway, Gerhardt⁹ and others have written convincing articles which have not attracted the attention they merit. It is beside our subject to discuss the fever of initial or secondary syphilis. Under the next topic luetic pyrexia will be again considered.

(C) THE MIMICRY OF TOXEMIC AND SEPTICOPYEMIC CONDITIONS BY SYPHILIS OF THE LIVER. 1. *Hepatic Gummas Resembling Abscess of the Liver.* Luetic liver symptoms, as pain, tenderness, and enlargement, together with fever, chills, and other septicemic manifestations, may closely resemble liver abscess. In a patient of Dr. Lesage there was an exquisitely tender point in the epigastrium, with a leukocytosis of 21,000, chills, fever reaching 102° or 103° over a period of nine months, and a loss of 40 pounds in weight. Under mercurial injections and iodide of potash internally, every symptom subsided in a week, never to recur. Trinkler, Lenhoff, and Ebstein noted a pseudofluctuation which heightened the resemblance of liver abscess. In most of the writer's cases, the leukocyte count did not run high, but in three instances it ran 21,000, 17,300, and 15,200. The fever may be most deceptive,¹⁰ and in hepatic differentiation fever argues scarcely more for abscess than for syphilis.

2. *Gummas of the Liver Simulating Tuberculosis, Typhoid Fever, Septicopyemia, Malaria, etc.* In the absence of any localizing visceral, e. g., hepatic symptoms, fever alone may prove most deceptive. In one patient, seen with Dr. Black, the fever ran many weeks; blood cultures were negative, the Widal reaction was negative, and until the autopsy disclosed widely diffused gummas in the liver, typhoid fever, sepsis, and meningitis were considered, but without any definite conclusion being reached. E. G. Janeway¹¹ reported cases in which the fever simulated pulmonary tuberculosis. Bäumler described cases suggesting tuberculosis and typhoid fever, and Mannaberg described an intermittent fever mistaken for malaria and septicemia, until antisypilitic therapy dissipated all doubt.

⁶ Mitteilung aus dem Grenzgebiet. d. Med. u. Chur., 1904, x, 726.

⁷ Deut. Archiv f. klin. Med., 1872, ix, 397.

⁸ Ztsch. f. klin. Med., 1907, lxi, 253.

⁹ Deut. Archiv f. klin. Med., 1908, xcii, 236.

¹⁰ Deut. Archiv f. klin. Med., 1908, xcii, 236.

¹¹ AMER. JOUR. MED. SCI., September, 1898, p. 251.

⁹ Berl. klin. Woch., 1900, p. 1046.

3. *The Prolonged Pyrexia of Pylephlebitis.* The unusually long course of the reported and almost unique case is depicted in the appended chart, and also the pyemia-like chills and steep curves.

In an analysis of the causes of pylephlebitis, Lissauer¹² found enlarged portal lymph glands in 46 per cent., splenic abscess in 28 per cent., pancreatic cancer in 24 per cent., primary hepatic cancer in 11 per cent., appendicitis in 5 per cent., and syphilis of the liver, primary gall-bladder cancer, and secondary hepatic cancer, each in 4 per cent., etc.

CONCLUSIONS. As suggested in the introductory epitome:

1. What is seemingly a suppurative pylephlebitis, with intensely septicopyemic symptoms, may be syphilitic pylephlebitis with spirochete sepsis.

2. There is always the possibility that various vague or obvious portal-vein, gall-bladder, and liver symptoms may be syphilitic—a possibility of vast therapeutic significance.

3. A diagnosis of syphilis made *ex juvantibus* may be open to criticism; while not of absolute certainty, such means of diagnosis of syphilis exceed the degree of probability.

4. Hepatic gummas may precisely simulate hepatic cancer, even to the extent of the characteristic cachexia, and perhaps, also, of the significant gastric findings.

5. Certain cases of seeming atrophic cirrhosis may respond to antiluetic remedies.

6. Cholelithiasis, cholecystitis, and hepatic abscess may be simulated by syphilis of the liver.

7. Tertiary invasion of the liver or portal vein may run its course without localizing signs, and masquerade as typhoid fever, septicemia, tuberculosis, or malaria. When the Widal reaction, blood cultures, tuberculin test, and examination for plasmodia are negative, it is not fantastic to suggest the employment of mercury and iodides.

STRETCHING OF THE CARDIA IN THE TREATMENT OF CARDIOSPASM AND IDIOPATHIC DILATATION OF THE ŒSOPHAGUS.¹

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LATELY² I reported a case of idiopathic dilatation of the Œsophagus, in which, by stretching the cardia with a metallic cardio-

¹² Virchow's Archiv, xcii, 278.

¹ Read at a meeting of the American Gastro-enterological Association, St. Louis, Mo., June 6, 1910.

² Report of a Case of Idiopathic Dilatation of the Œsophagus, New York Medical Journal, May 29, 1909.

dilator, constructed by myself, a cure was effected. In that paper the literature was referred to. Now I would like to report on this method of treatment in two cases of cardiospasm and in three new cases of oesophageal dilatation. If we reflect that until recently idiopathic dilatation of the oesophagus was considered by most clinicians as an incurable affection, the present paper on the subject may not be deemed superfluous.

Before entering into a description of the cases I may be permitted to add a picture of the cardiodilator as I have slightly modified it since the appearance of my first publication. The instrument (Fig. 1) is provided with a scale for the dilatable part and is made in two sizes, one dilating up to 8 cm., the other up to 10 cm. in circumference.

As to the relations between cardiospasm and idiopathic dilatation of the oesophagus, the following remarks apply: Cardiospasm is a relatively frequent affection, which occurs much oftener in the female sex, and is generally based upon a nervous foundation. The symptoms occur during or immediately after the small meal (for these patients take only a little and that cautiously and slowly). There is a feeling of pressure in the chest, frequently turning into pain. Vomiting usually does not occur. Improvement often takes place, lasting for a long period, only to yield to a return of the trouble. While the cardiospasm lasts the swallowing sound is often delayed, sometimes broken, rarely entirely absent. Even small quantities of food may cause these troubles, since they pass the oesophagus only with discomfort; therefore, we usually do not find dila-

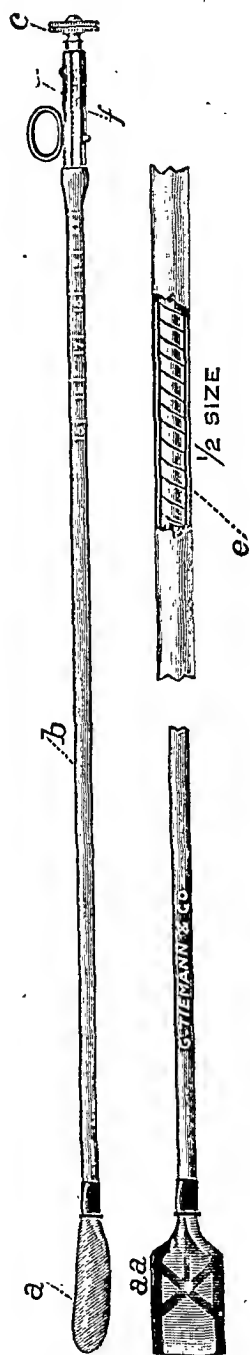


FIG. 1.—The cardiodilator. *a*, expanding end; *b*, flexible shaft; *c*, pilot wheel; *d*, handle and casing for actuating mechanism; *e*, flexible spiral shaft enclosing transmission wire; *f*, scale; *aa*, expanding end when giving maximum dilatation.

tation of the œsophagus. When, however, the cardiospasm becomes continuous, and has lasted many months or even years without interruption, a marked dilatation of the œsophagus will slowly develop.

If the latter is present, no matter whether due to cardiospasm or other causes, the clinical picture is different and accompanied by grave symptoms. The patient can apparently take a little more food without discomfort, but this is soon followed—as the œsophagus becomes distended with food—by severe symptoms. The sensation of pressure may be intensified to a feeling of choking. The patient tries to help himself by further drinking of water and compression of the thorax. If he does not succeed in forcing the food from the œsophagus into the stomach, the contents will be ejected through the pharynx and mouth. The œsophagus is rarely entirely empty, and generally contains remnants which putrefy and exert an irritation upon the walls of the œsophagus.

There now arise disagreeable sensations even between meals, and occasionally food will ooze into the larynx in the recumbent position (during sleep), which causes the patient to wake up with paroxysmal coughing. The suffering is continuous. If the patient feels better at times, he is still never entirely free from trouble; the latter is only a little less acute. The patient can never eat a meal with pleasure, but must always interrupt it, in order to help himself through the manœuvres detailed above. Objectively the swallowing sound in these cases is always absent, and an x-ray picture readily shows the greatly dilated œsophagus.

Before I enter upon a description of the new cases, I would like to remark that Miss Kate G., whose case was described in my paper cited above, has remained entirely well since the stretching of the cardia, and has gained about 50 pounds in weight. The cases that I have since observed are as follows:

CASE I.—April 13, 1910. *Cardiospasm.*

Mrs. I. S., aged twenty-four years, has three children, the eldest three years old, the youngest seventeen weeks. Three weeks after the birth of the last child, or about three months ago, she suddenly experienced a cramp in the epigastrium. Since that time she complains of difficulty while eating. When she eats, the food seems to stick in her throat and she has the sensation of choking. By pressing she was able to get the food into the stomach. When this was not successful, she put her finger in her throat and vomited. The swallowing sound is present after eighteen seconds in an interrupted manner. Bougie No. 43 French passes the cardia. The cardia was at first stretched to 6 cm., later to 7 cm.³ Immediately after the first stretching the patient could eat better and the swallowing

³ Before inserting the cardiodilator it is advisable to test the screw arrangement as to its working perfectly.

sound was present at once. The patient gained in weight and felt very well.

CASE II.—March 30, 1909. *Cardiospasm and Moderate Dilatation of the Œsophagus.*

Mrs. Pauline B., aged thirty-four years, had rheumatism when eleven years old; otherwise she has been quite well. Three years ago she began to be troubled with belching of gas and difficulty in swallowing her food. It would go down as far as the cardiac orifice; then she would have a cramp and would have to straighten up and wait until she would be relieved. Sometimes it only took a few seconds, sometimes longer; again she would have to walk about in order to overcome the sensation. During the night at times a sudden cramp in the same spot would awaken her. This would last from fifteen to twenty minutes. By rubbing and drinking hot water she would feel relieved. When lying on her left side and back the cramps occur more frequently than when she lies on her right side. There is constipation, but no headaches. Solid food agrees with her much better than liquids. Acids and sour fruits are very bad.

The examination revealed atony of the stomach, right movable kidney, and slight hyperchlorhydria. These conditions not explaining her real trouble, she was examined with regard to her Œsophagus.

The swallowing sound was found to be absent. A whalebone bougie (54 French) encountered some resistance at sixteen inches from the teeth (cardia), but entered the stomach. The Œsophagus also contained some fluid mixed with food remnants, although the quantity was small (about two ounces).

The diagnosis of cardiospasm with very moderate dilatation of the Œsophagus was made, and patient treated by stretching with the cardiodilator. At the first stretching dilatation of the cardia to 7 cm. was accomplished, then up to 8 cm. for one minute. This treatment was carried out during the months of April and May, 1909. The patient was relieved from her attacks and could eat ordinary food and liquids. She remained well for about seven months, when the attacks reappeared, although in a mild degree. Her cardia was again stretched for one minute to 8 cm. on January 10, 1910, whereupon complete relief was experienced.

CASE III.—April 6, 1910. *Cardiospasm with Moderate Dilatation of the Œsophagus.*

Sister G., aged thirty years, had pleuropneumonia of both lungs about four years ago, which lasted six weeks. Last September (seven months ago), while carrying a box of candles and walking down stairs, she missed a step, and in order to save the candles she fell, and struck her left side in the region of the lower ribs. She had no pain after the fall. The following morning, on an empty stomach, she vomited coffee-ground material and had a stitch in her side (left hypochondrium). Since then she has vomited every day

(for the last seven months); once three times in the day. She always vomited small quantities of liquid. She has a pressure in the chest, as if every mouthful of food would stiek there. She never experienced a sensation as though the food would suddenly slip into the stomach. Her only relief is the vomiting, which occurs practically after each meal. The vomited matter is very sour, sometimes frothy and mucous. The bowels are constipated, the appetite is poor, and the patient has lost 38 pounds since her trouble began. The swallowing sound is absent. A bougie 43 passes into the stomach. The duodenal bucket reached the duodenum and there was no blood stain present.



FIG. 2.—Radiogram of the œsophagus of Sister G., taken April 12, 1910, after ingestion of bismuth and cream. The œsophagus shows moderate dilatation.

On April 9, 1910, the cardia was dilated up to 6 cm. for one minute. She felt pain, so that it was thought best not to dilate further. Somewhat later she drank a mouthful of water, and a swallowing sound was present immediately. On April 11 the

cardia was stretched for one minute to 8 cm. The patient took her meals nicely and did not vomit.

An x-ray picture was taken on April 12. It shows a moderate dilatation of the oesophagus (Figs. 2 and 3).⁴ Twice weekly the cardia was stretched for one minute to 8 cm.



FIG. 3.—The same as Fig. 2 a few minutes later, when the patient (Sister G.) had partaken of a glassful of milk. Most of the bismuth has passed into the stomach; there is, however, still an irregular line of bismuth visible along the oesophagus.

On April 30 patient felt very well and had gained 17 pounds in weight in the three weeks after the treatment was instituted. She ate ordinary foods without inconvenience and there was no trace of vomiting. The swallowing sound was present after six to seven seconds in a normal manner.

CASE IV.—December 8, 1909. *Idiopathic Dilatation of the Oesophagus.*

Mrs. E., aged fifty-one years, has had eight children, five being alive. She was formerly always well. After the death of her son, in

⁴ I am indebted to Dr. L. G. Cole for the radiograms.

1904, which affected her a great deal, she began to feel sick. She weighed at that time 237 pounds; and lost 110 pounds up to October 1. At first in working, a little food would rise without any pain; she never had trouble in swallowing. From the very start the food rises just as it was swallowed. She was always hungry, but never ate much, because it always rose; pressing did not help it any; the attempt to bring the food into the stomach with the aid of drinking coffee did not succeed. Oil also was of no avail. Nothing ever ran out on lying down. Every morning immediately after rising, a cupful of fluid, never solid food, came up; never blood. Massage and deep breathing did no good. Even up to within a short period there were days when the patient could bring down potatoes or vegetables or cake in company. Sometimes, however, food would come up again. When excited it would be worse. The patient was never sick, nor was there any trouble in her family. During the first three months of her pregnancy she had a spasmodic cough without expectoration. She never had dryness in the throat or diminution of the quantity of urine. When she came to the German Hospital she could not even partake of fluid food, and was suffering in a high degree. She was admitted to the surgical division and Dr. Stetten kindly asked me to see the patient.

Examination showed a high degree of emaciation, the heart and lungs apparently normal, and nothing pathological in the abdominal organs. The swallowing sound was absent. Examination with the sound showed the following: The œsophagus contained about 300 c.c. of fluid, mixed with mucus and food of neutral reaction; in pushing the tube farther down it entered the stomach and a fluid containing a large amount of HCl was obtained. In using a whale-bone bougie (43 French) I found a slight resistance at 16½ inches (cardiac orifice), which, however, was overcome, the sound passing into the stomach. The diagnosis of idiopathic dilatation of the œsophagus was made. (In looking over my records I found that the patient had consulted me once about two years ago, and that at that time the diagnosis idiopathic dilatation of the œsophagus was made.)

At first the cardia was stretched up to 8 cm. twice weekly for one minute; later it was done once weekly. Immediately after the first stretching the patient could take food without feeling any discomfort. She gained rapidly in weight, so that three months later she had gained 40 pounds. The swallowing sound was then present.

CASE V.—May 10, 1902. *Idiopathic Dilatation of the Œsophagus.*

Clifford V. B., aged twenty-six years, suffered for two years from pains in his chest and eructation of food. In 1901 he had typhoid fever, which reduced him still more. In 1902 he weighed 125 pounds, felt weak, complained of cramps in his chest, and vomited frequently.

Examination of the chest and abdomen revealed nothing abnormal. In the fasting condition the swallowing sound was not present. A sound introduced into the oesophagus brought up 140 c.c. of fluid with food remnants, of acid reaction, no HCl. The tube was pushed farther into the stomach and a few cubic centimeters of fluid mixed with HCl was evacuated. If the patient drank a glassful of water, the entire quantity mixed with a little mucus could be obtained from the oesophagus after five minutes.

The diagnosis of idiopathic dilatation of the oesophagus was made and the usual treatment followed. The patient gained in weight, and felt better, but the difficulty of eating remained.

In 1904 I constructed a special instrument for this patient in order to dilate the cardia. The stiff part, however, was too long, and its introduction did not succeed. Thus, the patient lived on, never able to enjoy a meal like others, always having to interrupt his meal in order to force the food down by certain manipulations.

On April 14, 1909, the patient was again examined. A condition similar to that described was found. The swallowing sound was absent. The tube introduced into the oesophagus (15 inches) brought up 200 to 300 c.c. of fluid containing food (reaction neutral or faintly acid; HCl = 0; ferments absent). On pushing the sound farther down (21 inches), stomach contents, with presence of free HCl, appeared. At that time the patient weighed 137 pounds stripped. On April 20 I began to dilate the cardia, at first up to 7 cm., later to 8 cm., then 9 cm., and finally 10 cm. Immediately after the first or second week of this treatment the patient could eat more easily and he soon was able to eat larger meals in the company of his friends without having to interrupt his meals. He steadily gained in weight, and in December weighed 177½ pounds, stripped. He had gained in seven months of treatment 40½ pounds in weight. The swallowing sound could then frequently be heard six to seven seconds after the drinking of water. Occasionally the oesophagus was entirely empty. After drinking 200 c.c. of water I could obtain after one minute only 50 c.c. from the oesophagus.

Particularly instructive are the x-ray pictures of the oesophagus. Fig. 4 is a radiogram of the oesophagus on January 29, 1907, before the treatment of stretching began, and Fig. 5 is that of January 14, 1910, about eight months after this treatment was instituted. It is evident that the transverse diameter of the oesophagus has become markedly smaller. Fig. 6 shows the oesophagus in the lateral position after partaking of thick bismuth mush. The peristalsis of the oesophagus can be seen. The patient then drank a glassful of milk, and another picture was taken in the same position immediately afterward. The oesophagus had emptied itself completely (Fig. 7).

EPICRISIS. Adding the case described before, I have now six cases of cardiospasm and idiopathic dilatation of the oesophagus



FIG. 4.—Radiogram of C. V. B.'s œsophagus after taking bismuth and cream.
January 29, 1907.



FIG. 5.—Radiogram of C. V. B.'s œsophagus after taking bismuth and cream.
January 14, 1910.



FIG. 6.—Radiogram of C. V. B.'s œsophagus after bismuth in the lateral position.
January 14, 1910.



FIG. 7.—The same as Fig. 6, after drinking a glassful of milk a few minutes after the bismuth, lateral position. January 14, 1910.

(two cardiospasm, four idiopathic dilatation of the œsophagus), which by means of forced stretching of the cardia were either entirely cured or so much improved that they may be considered almost cured. For even if a small residue is found in the œsophagus in some of these patients, still they do not experience any discomfort at meals and can partake of them in the same manner as normal persons. Case V (C. V. B.) deserves special mention, because the x-ray photographs before and after treatment by means of stretching show plainly the variation in size of the œsophagus, which is only one-third as large as before treatment. The success of treatment by means of stretching is very marked, and may now be regarded as the accepted mode of treatment in this disorder. These favorable results obtained by means of forced stretching of the cardia in cases of cardiospasm and diffuse dilatation of œsophagus have induced me to try a similar method of treatment in pylorospasm. I have, indeed, had apparently good results in some cases from stretching the pylorus.

A PRELIMINARY NOTE ON MEDICAL USES OF RECTAL INFUSIONS.

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THE use of the lower bowel as a channel for the introduction of fluids into the body dates back to early days in medicine, but since rational application of the method was devised by J. B. Murphy,¹ it has become one of the salient procedures in postoperative surgical therapeutics. It is not surprising that the practice of proctoclysis, which has become well nigh routine in the surgical clinic, should promise to assume a definite place in the wider field of medical treatment. But the procedure must degenerate into mechanical manipulation unless the indications for its service and the limitations of its usefulness are established by critical observation. An intelligent application of the method presupposes a definite notion of its mode of action and of the objects to be accomplished. From a theoretical point of view the following summary may be made of the distinctive vital relations of proctoclysis: (1) Rectal infusions would seem less disturbing to the economy than fluid offered to the body through any other channel. Fluid introduced into the lower bowel by the "Murphy method" produces a minimum of peristaltic reaction, and its absorption is probably regulated by the vital demands of the organism. (2) Warm rectal infusions have a diuretic

¹ Perforative Peritonitis, Surgery, Gynecology, and Obstetrics, June, 1908.

effect, which is frequently immediate and intense. In certain cases the amount of fluid expelled from the body by diuresis greatly exceeds that introduced by proctoclysis. (3) Soluble toxins proceeding from foci of infection impair the vitality and reduce the resistance power of the healthy tissues through which they circulate. The surgeon has a lively sense of the gravity of this incident as influencing tissue repair and general reaction after operation. The condition is no less important in medical cases of disease. Dilution of the circulating toxins with imbibed fluid and their removal by diuresis would seem not only to protect the kidneys by lessening the concentration of the poisons excreted, but tend to safeguard the sound tissues from intoxication. (4) Clinical observation indicates that microbic metastasis is prone to seek out regions where tissues have already been injured by circulating toxins. Thus, in gonorrhoeal infection there is reason to believe that joint pains due to transported toxins are apt to precede the local establishment of the cocci. Proctoclysis appears to ameliorate such pains and, inferentially, limit extension of the infection. (5) The addition of foreign fluid to the circulation is an important aid to the maintenance of a normal arterial blood pressure, possibly not so much by reason of the volume of fluid added as by reducing intoxication by the mechanism of circulation. (6) The exhibition of many medicines by way of rectal infusions commends itself as free from obvious disadvantages inherent to the oral channel.

For many years I have occasionally applied one or another method of proctoclysis in the medical clinic, but only during the last year has the method been somewhat systematically pursued according to the principles of Murphy's technique. In my observations the attempt has purposely been made to achieve results with the aid of such simple apparatus as is available in any bedroom. It is probable that the results would have been more satisfactory with a more adequate equipment. The fluid infused was tap water or normal saline solution, as the condition of the patient seemed to demand. One or two pints of fluid, rather hot to the touch, would be placed in the bag of a "fountain syringe" and introduced into the rectum through the hard rubber tip commonly used for enemas. The bag was usually suspended so that the surface of fluid within it should be elevated six to eight inches above the anus. The bag is raised or lowered according to the rate of outflow or complaints of the patient. Nearly two pints of fluid should flow out in the course of an hour. With this simple apparatus considerable difficulty is experienced from the cooling of the fluid in the outflow tube. This is partly remedied by keeping the tube under the bedclothes, or occasionally withdrawing the tip and allowing the cooled fluid to run off. The temperature in the reservoir may be maintained by the addition now and then of small quantities of very hot water or saline solution. As is well known, the essence of Murphy's method lies in

the free communication between the rectum and reservoir with the hydrostatic balance so slightly in favor of the latter that, while fluid surely gravitates toward the bowel, a slight excess of pressure within the rectum is relieved by a reversal of the current into the reservoir. The head of pressure in the reservoir should be so low that the distention occasioned by the flow should neither provoke contraction of the gut nor cause perceptible reaction of the anal sphincter. The special form of outflow tip, having a sharp bend in its course, which Murphy devised for patients treated in the Fowler's position does not seem necessary for medical patients that lie supine.

In my experience proctoelysis pursued in this manner is not always so indifferent to the comfort of patients as surgeons seem to find. Both the mechanical relations of the Fowler's position and the psychic distraction of a surgical injury probably combine to facilitate the application of the method in operative cases. With medical subjects it is often difficult to adjust the apparatus so as to avoid discomfort. The nurse is prone to raise the reservoir of fluid too high.

In practice it has been my habit to judge the utility of the method largely by the reaction of the kidneys. Abundant diuresis has been accepted as a sign of the efficiency of the procedure or vice versa. Instead of continuous proctoelysis, as commonly employed by the surgeon, I have usually sought the absorption of a quart of fluid twice daily, in forenoon and afternoon.

The cases on which this article is based may be divided into two groups: (1) Those in which it is desired to raise arterial blood pressure or, by stimulating diuresis, to deplete an effusion. (2) Those in which it is endeavored to reduce toxemia.

In the first group two cases gave such striking results as to form a basis for further observation. One was that of a man of middle age, probably an old alcoholic, prostrated with an asthenia of uncertain origin. Proctoelysis to the extent of two quarts of saline solution daily seemed an important aid to his gradual recovery. The other was that of a man of about sixty years, with pleural effusion, general dropsy, and orthopnea of myocardial origin. Hot water given by the "drop method" resulted in a progressive diuresis, which in a few days removed the dropsy and led to recovery of cardiac compensation. Other attempts to reduce dropsical effusions by proctoclysis have not been so successful, but the conclusion from a considerable experience favors the exhibition of hot water by the bowel in an effort to reduce dropsical accumulations which do not yield to other remedies. Of course, a comparison of the volume of fluid absorbed with that excreted quickly determines the availability of the method.

But it is the second class of cases, those suffering from constitutional toxemia, which offer the most pertinent field for proctoclysis. Already the method has been advocated, more or less modified, in the

treatment of typhoid fever and of scarlet fever. Durbin² has long used colonic saline irrigations with favorable results in the treatment of typhoid fever, and Riesman³ has recently reported satisfactory results obtained by the Murphy method. My own experience with proctoclysis in this disease has also been favorable, but is based on only a half-dozen cases. In a similar number of cases of lobar pneumonia, one of which was in an alcoholic with extensive lung involvement, high temperature, and wild delirium, I have been much impressed with the favorable effects when proctoclysis with hot tap water was made a therapeutic measure. The procedure was usually followed in a few hours by an abatement of the signs of toxemia, and especially by improvement in the mental condition.

Indeed, no class of cases has been more obviously ameliorated than that suffering from delirium. I have been struck with the rapid clearing up of the mental condition in obstinate cases of delirium tremens encountered in my wards of the Denver County Hospital. The resident interne assisting me, Dr. Elizabeth M. Collier, has continued the application of the method in such subjects since the lapse of my term of service, and reports very favorable results from it.

I have used saline infusions in four cases of scarlet fever, two of them very severe, and the results were admirable. The casts and albumin found in the urine early in the disease disappeared before the patients were ready to leave their beds.

In functional disorders marked by acetoneuria, great gastric irritability, and depression of renal activity, proctoclysis and the administration of bicarbonate and salicylate of soda by rectal infusion have proved of great value.

In a number of cases of chronic pulmonary tuberculosis having a daily rise of temperature, I have failed to see decided benefit from proctoclysis. But in intercurrent febrile, "grippal" attacks the comfort of the patient has been greatly increased and the invasion apparently cut short by the procedure. In the sudden flooding of the system with toxins from confined pus, which not rarely occurs in tuberculous subjects, remarkable amelioration of the symptoms may follow a saline infusion by the bowel.

In conclusion, it must be admitted that the favorable results accompanying the use of proctoclysis in appropriate medical cases indicate that this method of *quasi* internal hydrotherapy deserves such a thoroughly detailed study as will accurately establish its indications and limitations in medical therapeutics.

² Denver Medical Times and Utah Medical Journal, July, 1909.

³ Jour. Amer. Med. Assoc., January 29, 1910.

THE X-RAY TREATMENT OF STATUS LYMPHATICUS, WITH INFERENCES DRAWN THEREFROM CONCERNING THE PHYSIOLOGY OF THE THYMUS GLAND.¹

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IN 1907 Alfred Friedlander² reported a case of status lymphaticus with marked enlargement of the thymus and persistent stridor, which he treated successfully by the x-rays. Heinecke (quoted by Friedlander) demonstrated the selective action of the Röntgen rays on lymphoid tissues, including the thymus, and showed that under their action marked changes occurred in these tissues, with a reduction in their size. Friedlander's successful case directed attention to the x-ray treatment of enlarged thymus in connection with status lymphaticus, and led to the successful treatment by this method of a number of other cases. The purpose of this paper is to call attention to two of these cases which came under my direct observation, and to draw therefrom certain inferences concerning the physiology of the thymus gland.³

CASE I.—John X., born July 2, 1908, birth weight 6½ pounds, was apparently normal for one month, and was then weaned because of indigestion. When one month of age he choked on a calomel and soda powder, became greatly cyanosed, and was prostrated for a number of hours afterward. From this time on his mother noticed that there was great difficulty in keeping his feet warm, and that at times they were blue. About the middle of December, when five and one-half months old, he had an afebrile attack of "bronchitis" of the larger tubes, characterized by cough, coarse rales, wheezing, and dyspnoea; this attack lasted one month. In the middle of February he developed another attack of bronchitis, with the same symptoms as in the preceding attack, except that the cough was more violent and spasmodic. This attack continued until, on March 4, his adenoids were removed under chloroform anesthesia, in the hope of relieving these symptoms. Following the operation the child was better for two days, when the whole symptom group recurred; at this time there was marked stridor and dyspnoea, which interfered with his taking food. On April 3 a second and more radical operation was made for the removal of the adenoids and tonsils. Following

¹ Read by title at a meeting of the Association of American Physicians, Washington, D. C., May 4, 1910.

² Archives of Pediatrics, July, 1907.

³ For many of the facts used in this paper I am indebted to the writings of A. S. Warthin, in Osler's System of Medicine, the Transactions of the Association of American Physicians, 1906, and the Archives of Pediatrics, August, 1909; and to Pappenheimer's paper on the Histology of the Thymus Gland, in the Journal of Medical Research, February, 1910.

this operation for two or three days there was a slight improvement in his symptoms, and then his condition grew steadily worse. The cyanosis, stridor, and prostration increased until on April 12 he was brought to Cincinnati with the diagnosis of thymic asthma. I saw him on his arrival, and asked Drs. Forchheimer and Friedlander to see the case with me. We concurred in the opinion that the child had status lymphaticus and was suffering from thymic asthma. The thymus gland, greatly enlarged, was readily mapped out by percussion. A blood examination by Friedlander showed a chloroanemia and a well-marked lymphocytosis. The patient was pale, fat, and flabby. He suffered constantly from stridor, so severe that it was almost impossible for him to take food. He also had a severe paroxysmal cough, which came on at short intervals and increased the stridor into an attack of asthma associated with such great cyanosis that his life was threatened. The child was held the greater portion of the time stomach down, across the mother's lap; in this position the stridor was less severe. The lymphatic glands were increased in size, the spleen was slightly enlarged, and, as previously noted, the adenoids and tonsils had been removed. The tuberculin skin test was negative.

So urgent were the symptoms that the x-ray treatment was begun on the day of his arrival in Cincinnati, April 12, 1909. At each treatment the rays were applied both anteriorly and posteriorly over the region of the thymus. The rest of the body was carefully guarded from their influence. Sixteen treatments in all were given, extending over a period of six weeks. In the beginning the time of exposure to the rays was three minutes anteriorly and three minutes posteriorly. In the later treatments the exposure was eight minutes. The treatment was interrupted during the fourth week.

Within forty-eight hours after beginning the treatment there was slight improvement in the symptoms, especially the stridor, and this improvement continued steadily throughout the eight weeks he was under treatment. During this time the thymus gland was reduced to its normal size, and the dulness posteriorly on the left under the angle of the scapula, which we thought to be due to lymphatic enlargement and pulmonary compression, also disappeared. The paroxysmal cough and stridor had been almost entirely relieved and the child had gained steadily in weight and strength, but he still appeared anemic. On May 17 he was taken to his home in Kentucky, and within two weeks thereafter his father, who is a physician, reported that the cough and stridor had entirely disappeared, and that the child was apparently well. From the time the child returned home until the present time, April 11, 1910, he has had, at intervals of about three months, three very slight attacks characterized by cough and dyspnoea, which occurred without apparent cause and which were promptly relieved by one or two mild x-ray treatments. Apart from this he has presented the appearance of a sturdy infant developing

along normal lines. His father wrote me on April 11: "It will be just one year ago tomorrow since I took my baby to see you, and he now seems to be perfectly well. About three months ago he had another slight recurrence, which yielded promptly to two mild exposures to the x-rays. It seems that he may from time to time need an occasional treatment, but I shall remember your advice and not expose him to the rays unless there seems real occasion for it."

CASE II.—John Y., born July, 1908. When about six months of age it was noted that he had rapid heart action and difficulty in breathing from slight causes. From this time on these symptoms gradually increased in severity and the general symptom complex of status lymphaticus slowly became apparent. On November 1, 1909, I saw the patient for the first time with Dr. Sam Rothenberg, and from this time on he was cared for jointly by Dr. Rothenberg and myself. On this date the child was fifteen and one-half months old and presented well-marked and aggravated symptoms of status lymphaticus, which Dr. Rothenberg informed me had existed for some months. He was fat, flabby, anemic, and markedly lacking in physical development, especially his lower extremities. He had great dyspnoea, with well-marked stridor, which at times during the last few months was greatly aggravated by such slight causes as fits of anger, indigestion, and catarrhal conditions of the throat and nose. The child at times had a spasmodic cough, which would aggravate the stridor and produce cyanosis. The heart was dilated and its muscle weak and irritable. The action of the heart was rapid at all times, and this rapidity was greatly increased by the same causes which aggravated the stridor. The spleen, lymph nodes, and tonsils were enlarged, and there was a marked itching of the skin of the face and head, which caused the child to mutilate the skin of these regions by scratching. A well-marked enlargement of the thymus was demonstrated by percussion, and a blood examination by Dr. Max Dreyfoos demonstrated a very pronounced chloro-anemia and well-marked lymphocytosis. The blood examination was as follows: Hemoglobin, 65 to 70 per cent.; red corpuscles, fresh preparation, showed considerable poikilocytosis, a few "ameboid" micropoikilocytes, and, on the whole, the red cells were smaller than normal; the stained preparation showed 6 normoblasts to 500 whites counted; white corpuscles, 24,600; red corpuscles, 5,881,250; color index, 0.58; differential count, polymorphonuclear neutrophils, 25.6 per cent. small lymphocytes, 61.8 per cent.; large lymphocytes, 2.6 per cent.; large mononuclear leukocytes, 8.4 per cent.; eosinophiles, 0.6 per cent.; mast cells, 1 per cent.

The patient was immediately referred to Dr. Sidney Lang for x-ray treatment. In all, twelve treatments were given during the next six weeks, and during this time the symptoms of status lymphaticus gradually improved. There was an early and marked diminution in the size of the thymus and marked improvement in the stridor and

heart action; the spleen and lymph nodes grew smaller and the itching of the skin largely disappeared, but the child still presented a very anemic appearance. A blood examination on December 26, 1909, showed that the lymphocytosis had disappeared, but that the chloroanemia was slightly more aggravated than before. The blood state at this time was as follows: Hemoglobin, 50 to 55 per cent.; fresh preparation, reds pale and smaller than normal; considerable poikilocytosis and anisocytosis; stained preparation, polychromatophilia; 2 nucleated reds to 300 whites counted; white corpuscles, 6,800; red corpuscles, 4,675,000; color index, 0.56; differential count, polymorphonuclears, 38 per cent.; small lymphocytes, 46 per cent.; large lymphocytes, 6 per cent.; large mononuclear leukocytes, 7.67 per cent.; eosinophiles 1.66 per cent.; mast cells 0.67 per cent.

Following the above blood examination the x-ray treatment was discontinued and the child was given citrate of iron hypodermically. He continued to improve in general health and the slight amount of dyspnoea which still appeared at times continued to grow less. The heart was gradually reduced in size and its action became more normal. This improvement continued until January 12, when the child was taken ill with bronchopneumonia, from which he made a rapid recovery. February 27, a blood examination was made, with the following results: Hemoglobin, 90 per cent.; fresh preparation, reds smaller than normal; moderate poikilocytosis; considerable anisocytosis; rouleaux formation fairly well marked; white corpuscles, 14,500; red corpuscles, 5,906,250; differential count, polymorphonuclears, 69.25 per cent.; small lymphocytes, 22.5 per cent.; large lymphocytes, 3.25 per cent.; large mononuclears, 3.25 per cent.; eosinophiles, 1.5 per cent.; mast cells, 0.25 per cent.

It will be noted that the special point of interest in the above blood picture is the appearance of a polymorphonuclear leukocytosis, while the lymphocyte count remains low. It was suggested by Dr. Dreyfoos that this might be due to a slight influenza which the baby had at the time, and which had developed after Dr. Rothenberg and I had seen the baby and asked for the blood count on February 20. In this connection, however, it may be interesting to note that Rudberg, quoted by Pappenheimer, notes in his study of the regeneration of the thymus in rabbits following Röntgenization, that during the later stages of this regeneration there is a marked invasion of the thymus gland with polynuclear leukocytes derived from the blood. This would indicate that a polynuclear leukocytosis might be a physiological reaction following the x-ray treatment of the thymus. Without other treatment than fresh air and careful feeding this child continued to improve in general health, until on April 5, 1910, he presented the appearance of a normal child. The dilated heart had returned almost to normal size, and none of the symptoms of status lymphaticus were present. The child at this time was gaining in weight and developing along normal lines, and the blood state

below given is almost, if not quite, normal: Hemoglobin, 75 to 80 per cent.; fresh preparation, red corpuscles slightly under normal size; small number of poikilocytes; white corpuscles, 9800; red corpuscles, 4,881,250; color index, 0.9; differential count, polymorphonuclears, 48.33 per cent.; small lymphocytes, 39.67 per cent.; large lymphocytes, 2.66 per cent.; large mononuclear leukocytes, 3.67 per cent.; eosinophiles, 5.33 per cent.; mast cells, 0.34 per cent.

A study of this case indicates that the disappearance of the lymphocytosis under the x-ray treatment of the thymus gland in status lymphaticus is so marked that a careful study of the blood state in this condition will give important information not only as to the efficacy of the treatment, but as to the length of time this treatment should be continued. It will perhaps be wise to discontinue treatment when the lymphocytosis disappears, even though there still be left some cough and stridor. The chloro-anemia which is not improved under the x-ray treatment may be aggravated if it be continued too long. Following the x-ray treatment in these cases, hypodermic injections of iron, with careful feeding and fresh air, may be necessary to restore the blood state to a normal condition. In both of the cases here reported slight cough and stridor were present when the x-ray treatments were discontinued, but disappeared entirely a few weeks later.

PHYSIOLOGY OF THE THYMUS. The histology of the thymus gland is very fully discussed by Pappenheimer.⁴ It appears that while many points concerning the development and histology of this gland are still in dispute, it is rather generally conceded that it is relatively large in infancy and early childhood, but that it gradually increases in size up to the fifteenth year of life, and thereafter regressive changes slowly take place which diminish its physiological efficacy. It is also very generally believed that the thymus furnishes an internal secretion which exerts an important influence on nutritional processes, and that its period of greatest functional activity along this line is during foetal life and early childhood; this function falls off most rapidly after the fifteenth year, but probably remains more or less active throughout life. For a review of the various inferences and suggestions which have been made concerning the physiological functions of this gland the reader is referred to the papers by Warthin, previously noted.

It is my purpose here to call attention to the following facts, which I believe have been demonstrated by the x-ray treatment of the enlarged thymus gland in the condition known as status lymphaticus, and based upon these facts I shall offer an hypothesis concerning the functions of this gland, which, if true, will have an important bearing upon the pathology of this disease.

In the x-ray treatment of status lymphaticus in infants and young children, although no portion of the body is exposed to the

influence of the rays except that which directly holds the thymus gland, we have as a result of this treatment:

1. Decrease in size of the hyperplastic thymus, with the disappearance of the cough, stridor, and asthma.

2. Decrease in size of the enlarged spleen and lymph nodes.

3. The exhaustion and general feebleness of constitution gives place to normal conditions of health and strength, and physical and intellectual growth are greatly stimulated.

4. A rapid disappearance of the marked lymphocytosis which characterizes this disease.

5. Excessive physiological action of the thymus gland is controlled. The slight return of the symptoms, stridor, cough, etc., at intervals of three or four months in one of my cases, and the quick control of these symptoms by one or two exposures to the x -rays, indicate that the gradual regeneration of the thymus following the x -ray treatment may be accompanied by a gradual reproduction of the same pathological conditions, hypersecretion, etc., which were present before the treatment was begun.

Since the above remarkable results are brought about by the action of the x -rays on the thymus gland, it would appear that the excessive physiological activity of the thymus gland bears the same relationship to status lymphaticus that excessive activity of the thyroid gland bears to exophthalmic goitre. One seems justified in inferring from the above facts that the exciting cause of true status lymphaticus acts primarily on the thymus gland, commonly producing marked hyperplasia of this organ with an increase in or perversion of its internal secretion, and that this increased or perverted secretion is responsible for the general hyperplasia of lymphoid tissues, the lymphocytosis, and general feebleness of constitution which occur in this disease. This inference seems justified by the facts above noted, that the general hyperplasia of lymphoid structures, as well as all of the other symptoms of status lymphaticus, disappear when the x -rays reduce the thymus to normal size and, perhaps of more importance, to normal functional activity.

If the above hypothesis be true, that under pathological conditions an excess or perversion of the internal secretion of the thymus may produce hyperplasia of the thymus gland itself and of lymphoid tissues in general throughout the body, the inference seems plain that the normal thymus gland, which is at the height of its functional development in intra-uterine and early extra-uterine life, exercises a preponderating or controlling influence over the lymphoid tissues of the body, their functional capacity being increased or diminished by the increase or diminution of the internal secretion of the thymus. This hypothesis is in accord with the increased activity of lymphoid tissues during early life, and with the gradually diminishing activity of these tissues in later life, as the physiological atrophy of the thymus gland gradually diminishes its internal secretion.

The hypothesis that the thymus gland during infancy exercises an influence over the functions of lymphoid tissues explains many of the observations which have been made in connection with this gland.

Up to the present time, according to Warthin, seven cases of enlarged thymus producing thymic asthma have been cured by the partial or complete removal of the enlarged gland. One of these cases operated on by König was an infant only nine weeks old. Complete relief from the symptoms followed the operation, but König subsequently advised against complete thymectomy in these cases, because the patient operated on by him afterward developed rickets and did not walk until after it was four years of age. It will be noted that this case was operated upon at the very time in the life of the infant when the thymus gland is most active, and the infant was thereby deprived during the first and second year of its life of the physiological function of this organ, and thereby suffered profound nutritional disturbances.

The experiments of Basch, to the effect that extirpation of the thymus in "young" dogs is followed by lack of bony development and serious nutritional disturbances, is in accord with König's observations. Stokes, Ruhrah, Rohrer, Dudgeon, Bovaird, Nicholl, and many others have noted the fact that primary marasmus is associated with thymic atrophy. Warthin says that in primary marasmus thymic atrophy appears to be constant, and that similar changes also occur in the spleen and lymph glands, "suggesting a general lymphoid exhaustion." In these cases it would appear that the thymic atrophy is the initial lesion and one of the causative factors in the production of infantile marasmus. This condition would naturally occur if by destroying the functional activity of the thymus a "general lymphoid exhaustion," or general functional debility of all the lymphatic tissues resulted, in conformity with the hypothesis above outlined.

Warthin says that "in true acephalic monsters the thymus may be entirely absent, and up to the present time such cases are the only ones in which a total absence of the organ has been definitely shown to exist." These facts apparently indicate that there is some relationship between the absence of the thymus and the lack of development here referred to. If this be true, it points to the conclusion that the thymus gland during intra-uterine life exercises, by means of some internal secretion, a powerful influence over the metabolic processes which are necessary to the normal development of the fetus. This conclusion is in accord with the hypothesis that the thymus gland exercises a controlling influence over the development and functional activity of lymphoid tissues.

Svehla⁵ prepared fresh and dried thymus glands and fed them to dogs, with the following results: (1) Drop in blood pressure, as a result

⁵ Wien, med. Blatt., 1896.

of weakness and paralysis of the vasoconstrictors. (2) Acceleration of the pulse due to the action of the toxin on the heart. (3) Large doses produced death of the animals, with restlessness, collapse, and dyspnea, and postmortem examination showed death from suffocation.

Sachsa⁶ injected a 10 per cent. watery solution into crural veins, and produced a fall in blood pressure, acceleration of the pulse, and death from acute suffocation. This toxic action was more marked in young animals. Both Svehla's and Sachsa's conclusions, that thymic asthma and thymic death may be due to hyperthymization of the blood, are in accord with my hypothesis.

On finishing this paper there came to my notice the research of Lucien and Parisot.⁷ These observers made a careful study of the influence of thymectomy in rabbits, and found that in very young animals removal of the thymus was followed by a noticeable retardation of growth. The changes in the skeleton were in the weight and general dimensions of bones; no curvatures, epiphyseal enlargements, or bony softenings were found. The testicles and ovaries were diminished in size, corresponding with the lack of development of the organism in general. All of these changes were less noticeable in older animals, and did not occur at all in animals that had attained their full development. These findings of Lucien and Parisot may be explained by the hypothesis above advanced.

A CASE OF SPLENOMEGALY ASSOCIATED WITH MARKED ANEMIA OF THE PERNICIOUS TYPE.

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THE following case seems worthy of being put on record, as it presents many unusual features. The patient has been under observation in London and Toronto during many years, and the history can thus be followed out in a way that is often not possible. The diagnosis offers many difficulties, but if, as seems probable, it be one of pernicious anemia, with a very large spleen, then in several ways it is a case of great rarity.

W. P., aged twenty-eight years and six months. Single. Lead glass worker. Admitted to the Toronto General Hospital on June 12, 1909.

⁶ Centralbl. f. allg. Path. u. path. Anat., 1897.

⁷ Archiv. méd. exper. et d'anat. path., January, 1910.

Complaints. Weakness, shortness of breath on exertion, and swelling of the abdomen.

Duration. About four weeks, but, as the history will show, he has not been really well for at least twenty years.

Family History. Father alive and well. Rheumatism four times. Mother alive but delicate. Brothers, two; one died of whooping-cough; one healthy. Sisters, none. No history of tuberculosis or syphilis in the family. No history of any disease resembling what the patient now suffers from.

Personal History. Born in London, England. Came to Canada many years ago. Has been a lead glass worker for years. Fairly comfortable surroundings and always has good food. No venereal history.

Previous Health. Was a small, weakly baby. Had measles at the age of four. When eight years old was in the Great Ormond Street Hospital suffering from "jaundice," and remained there four months. (Notes of this stay are not obtainable.)

At ten years of age was readmitted to the Great Ormond Street Hospital, March 5, 1890, complaining of headache and dull abdominal pain. A summary of his condition then, as given by Mr. R. S. Frew, the Registrar to the hospital, is as follows: "Very thin boy. Skin pale lemon color. Conjunctivæ slightly tinged. No eruptions or oedema. Lips pale and gums slightly swollen. Tongue pale. Cervical glands enlarged, especially on the left side. Temperature, 101°. Abdomen not distended. Prominence in left hypochondrium reaching to umbilicus and descending on respiration. Spleen reaches to within 1½ inches of left anterior superior iliac spine. Notch in its anterior border evident. Liver palpable below costal margin. Heart not enlarged, but systolic murmurs in all areas, conducted into axilla. Chest normal. Blood: Red cells, 1,000,000, white cells, 18,000, hemoglobin, 12 per cent.; March 25, hemoglobin, 25 per cent.; April 1, red cells, 1,625,000, white cells, 26,625, hemoglobin, 25 per cent.; April 17, red cells, 1,100,000, white cells, 7750, hemoglobin, 40 per cent.; April 28, red cells, 1,700,000, white cells, 10,000, hemoglobin, 40 per cent. Blood smear normal. Diagnosis, enlarged spleen."

Was readmitted in September, 1890 (aged ten years and nine months). "Since discharge had gradually become short of breath; lost color; had pains in head and abdomen; no hemorrhages nor vomiting. He was yellowish in color. Temperature, 100°. Glands enlarged along posterior border of sternomastoid, and shotty in left groin. Elsewhere were normal. Spleen was much enlarged. Liver not palpable. Systolic murmurs as before. Urine contained no albumin or sugar. Blood: Red cells, 1,111,000; white cells, 10,000; hemoglobin, 25 per cent.: September 17, red cells, 2,900,000; white cells, 10,000; hemoglobin, 46 per cent.: October 13, red cells, 3,500,000; white cells, 14,000; hemoglobin, 70 per cent. Optic disks normal. Sent to Convalescent Home."

February 9, 1891. "Reported at the out-patient department. Is paler again. No pain. Spleen reaches to one inch beyond the umbilicus. Blood: Red cells, 700,000; white cells, 21,200; hemoglobin, 19 per cent. After that was twice at the Great Ormond Street Hospital as an in-patient at short intervals. The condition was much the same, and he always temporarily improved."

The patient next turned up at St. Mary's Hospital, under the care of Dr. (now Sir) John F. H. Broadbent, who writes that he well remembers the case; and we are indebted to Dr. M. Mitchell Bird, the medical superintendent of the hospital for further notes, which are condensed to the following: The patient was admitted on July 23, 1894, then aged fourteen years. He complained of dyspnoea, anemia, slight cough, and extreme weakness. He stated that his periods of good health had been longer after each course of treatment at the Great Ormond Street Hospital. Had been fairly well before the present attack. He was of a pale yellow color. Spleen much enlarged. Liver palpable below the costal margin. Loud systolic murmurs audible all over precordium. Blood: Red cells, 800,000; white cells, not increased; hemoglobin, 25 per cent. He was treated with rest, arsenic, and iron, and left the hospital much improved.

During the next fourteen years of his life the patient says that he has been well and has never been laid up nor required medical advice. About a month ago, however, his old symptoms of weakness, dyspnoea, and yellow pallor returned, and he has been very poorly since. A week ago he fainted. He entered the Toronto General Hospital on June 4, 1909.

Condition on Admission. Patient is a well-developed man. Skin has a yellow and pallid hue and the conjunctivæ are distinctly jaundiced. In the folds of the axillæ and elsewhere there is considerable pigmentation. He gives a negative Moro reaction. Temperature, 100.3°, and all through his stay in the hospital there was slight elevation of the temperature. The lymphatic glands on the right side of the body are slightly enlarged. (The enlargement was on the left side in boyhood according to the records.) There is no tenderness over the long bones. No wrist-drop or trophic changes suggestive of lead poisoning.

Alimentary System. The teeth are poor and carious. The spleen is greatly enlarged and reaches to half an inch beyond the umbilicus. It is firm and free from tenderness. The notch is very evident and there is a slight shallow groove across the surface of the organ. The liver is not enlarged. The stools are somewhat clay-colored.

Circulatory System. Some dyspnoea and faintness on exertion. He can lie down in bed. No œdema or cyanosis. Pulse is regular and of medium systolic pressure, but collapses between the beats, almost suggesting a "water-hammer" one. The heart is not evi-

dently enlarged. Systolic murmurs are audible all over precordium and there is a loud *bruit du diable* in the neck. There is a slight retraction at the right apex, but otherwise the respiratory system seems normal.

Urine. Quantity normal. Dark red in color, but does not give the bile reaction with nitric acid. A trace of albumin. No indican. Many crystals of calcium oxalate, uric acid, and urates.

Nervous system normal. Nothing abnormal in *fundi oculorum*.

Blood. Shows a marked anemia of the pernicious type, in that the color index was persistently 1 or above. The results of the frequent examinations are collated in the following table:

BLOOD EXAMINATIONS.

Date.	Hemoglobin.	Red blood cells.	White blood cells.	Nucleated red blood cells.		Polynuclears.	Eosinophiles.	Basophiles.	Lymphocytes.		Normoblasts.	Megaloblasts.	Total nucleated red blood cells.
									Large.	Small.			
1909					Differential Counts.								
June 12	28	1,152,000	28,000	10,890		65.40	1.57	1.57	3.77	27.67	11.31	27.60	38.91
June 13	..	1,440,000	25,700	13,261		65.00	2.00	0.60	5.80	26.40	22.25	29.35	51.60
June 14	26	..	23,900	9,010		63.30	1.60	0.60	7.30	27.20	17.70	20.00	37.70
June 15	25	1,520,000	18,000	5,997		63.70	3.20	1.60	4.16	27.20	16.33	17.00	33.00
June 16	31	1,750,000	14,800	5,097		58.36	4.73	1.26	5.04	36.00	..	..	34.44
June 17	34	1,724,000	14,000	5,250		60.00	1.90	2.52	2.52	32.70	15.40	22.10	37.50
June 18	38	1,824,000	16,000	..		..	..	..	..	..	..	..	..
June 19	40	1,856,000	12,000	3,624		62.42	3.18	2.20	4.80	27.07	12.40	17.80	30.20
June 20	40	2,018,000	14,800	5,772		55.60	2.50	1.20	3.20	37.30	12.90	26.10	39.00
June 21	..	2,800,000	18,000	7,560		60.10	1.60	2.20	5.10	30.87	14.80	27.30	42.10
June 22	41	2,280,000	11,600	..		..	..	..	..	..	..	..	..
June 23	45	2,180,000	12,000	3,345		61.50	3.54	1.60	3.50	30.00	8.33	19.55	27.88
June 24	45	2,264,000	14,000	2,261		70.90	1.60	1.30	4.00	22.20	5.45	10.70	16.15
June 26	45	..	11,600	2,784		65.70	1.60	0.60	6.70	25.30	7.00	17.00	24.00
June 29	46	2,300,000	11,600	1,032		67.50	2.00	1.00	3.20	26.30	3.80	5.10	8.90
July 2	48	2,600,000	11,200	..		..	..	..	..	..	..	..	..
July 6	50	2,964,000	11,300	247		62.00	3.00	..	6.50	28.50	2.50	2.00	4.50
July 9	46	2,890,000	5,500	..		..	..	..	..	..	..	..	..
Nov. 28	..	..	..	..		64.50	4.50	1.50	3.00	26.00	0.50	1.00	1.50
1910													
Feb. 13	..	..	..	..		74.20	5.80	1.00	4.50	14.50	0.30	1.30	1.60

The white cells showed marked signs of immaturity or a tendency to degeneration. Some large mononuclear forms seemed closely to resemble myelocytes, but their structure was too definite. Many of the polymorphonuclears were very small, and a tendency to acid staining was evident.

The chief change in the blood was in the red cells. Fully 50 per cent. of the non-nucleated forms showed staining in an atypical bluish tint. Stippling was marked, varying from a few coarse blue granules to hundreds of coarse or fine ones, so closely packed as to produce a close resemblance to an atypical white cell. The question naturally arises here of whether the lead-working occupation of the patient had anything to do with this, but as both in pernicious anemia and in splenic anemia such staining is common,

this suspicion loses much of its weight. The poikilocytosis of the non-nucleated forms was mainly in regard to size, although many cells were irregular in outline and even rosette in form. Some of them were very large.

Many cells were so destitute of staining as to appear as mere ghosts, with just a faintly staining outline.

The nucleated red cells were exceedingly variable in form. The majority of them showed a primitive form of nucleus with a definite chromatin network and frequently more than one nucleolus. They answer very closely to the appearance of bone marrow, or lymphoid cells, which, according to many are the mother cells alike of the red and most of the white corpuscles. These cells not infrequently showed mitotic figures. The other nucleated red cells showed a uniformly intensely blue staining nucleus, or several nuclei, up to seven; an atypical budding process appearing in some cases. Free nuclei of this description were frequently noted in the smear, some just becoming detached from the cell body. These nuclei made the differentiation of lymphocytes a difficult matter. The majority of the nucleated red cells were megaloblasts, though normoblasts and some microblasts were present.

The smears were made on slides, stained by Wright's usual technique, and were counted under a Zeiss $\frac{1}{2}$ oil-immersion lens. The cells were counted by the same Thoma-Zeiss hemocytometer throughout.

The hemoglobin was estimated by two separate readings with the Dare hemoglobinometer.

Smears made by the patient at his home in November and February last showed more regularity in size and shape of the red cells, but still many nucleated forms. The color index as mentioned was always 1 or above 1.

During his stay in the hospital the patient improved greatly, he rapidly gained strength, his jaundice disappeared, and the spleen became rather smaller.

On February 13 last he writes that he thinks that his spleen is down to *its* normal size, and that he feels as well as he ever did in his life. This letter was of the same date as the last smear in the table, in which the still abnormal condition of the blood is evident.

REMARKS. The blood picture alone would suggest a diagnosis of pernicious anemia; the marked number of nucleated red cells and especially the great proportion of megaloblasts making it probable that we had to deal with the plastic form of this disease. The splenomegaly, although being unusual in pernicious anemia, would by no means exclude it, as cases are on record in which the spleen was quite as big as in our case, in which the disease was undoubtedly of the pernicious type. Osler records such a case, which was at first taken to be one of splenic anemia, but subsequently came to

postmortem and proved to be one of pernicious anemia,¹ and in something like 1 per cent. of all cases of pernicious anemia the spleen is so large as to reach to the umbilicus.² But assuming for the moment that the case be one of pernicious anemia, even then it presents several most unusual features. In the first place the disease commenced at the age of eight years, if not earlier, which is very unusual. Again, it has lasted for at least twenty years, and the patient is still in comparatively good health; and yet the longest cases recorded, apart from six cases of apparent recovery, only lasted between fourteen and fifteen years (Cabot³). Further, according to the patient's history, he was so well between the ages of fourteen and twenty-eight that he was never laid up nor required any medical advice—that is, he seemed to have a remission of fourteen years, and yet the longest recorded remission from prostrating symptoms on record is six years,⁴ although McPhedran⁵ recently has reported a case in which there was a remission for seventeen years.

As regards splenic anemia, the enormous size of the spleen with the marked anemia and a normal differential white blood count would superficially suggest such a diagnosis, but the very profoundness of the anemia would be against this conclusion, and further, the fact that the anemia was always of the pernicious form with a high color index would seem to exclude this diagnosis.

Other forms of splenomegaly with anemia, such as congenital syphilis, tumor, malaria, and even a possibility of filaria were all carefully weighed and excluded.

The case would appear to be either one of pernicious anemia of an exceptionally prolonged type, commencing at an exceptionally early age, and associated with an exceptionally large spleen, or one of splenic anemia with an exceptional blood picture.

The patient has left Canada for the United States, and we hope that his condition may be followed out by whomsoever he may consult.

¹ Transactions of the Association of American Physicians, 1902.

² Osler's Modern Medicine, iv, 765.

³ Ibid., 635.

⁴ Ibid., 633.

⁵ Amer. Jour. Med. Sci., 1910, cxl, 261.

THE SPINAL CORD LESIONS IN TWO CASES OF PERNICIOUS (ADDISONIAN) ANEMIA.

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THE following cases of spinal cord lesion with anemia belong to that group first described by Lichtheim¹ in 1887, and by many observers since, such as Bastianelli², Burr,³ Clarke,⁴ Jacob,⁵ Jacob and Moxter,⁶ Lenoble,⁷ Putnam and Taylor,⁸ Russel,⁹ Nonne,¹⁰ and especially by Putnam¹¹ and Dana¹² in this country, and recently termed by certain German observers pseudocombined sclerosis. The two patients whose records are presented were under the independent observation of several clinicians in three large hospitals of New York: Drs. W. Gilman Thompson, W. B. Pritchard, L. A. Conner, and T. W. Hastings, to whom we are indebted for the early records, extending back in one case three years, in the other five years. The first case we saw in Dr. Pritchard's service in the City Hospital, and the second case was under the personal observation of one of us for a year in the Cornell Dispensary and the City Hospital.

CASE I.—Under observation five years; symptoms and signs of pernicious anemia; no neurological features; at the postmortem the characteristic changes of pernicious anemia; in the cord, from the

¹ Zur Kenntniss der im Verlaufe der perniciosen Anämie, etc., Verhandl. des VI Congress f. innere Med., Wiesbaden, 1887, p. 84.

² Le sclerosi combinale de midollo spinale nelle anemie perniciose, Bulle. Roy. Acad. di Roma, 1895-96, xii.

³ The Spinal Cord Lesions and Symptoms of Pernicious Anemia, Univ. Med. Mag., 1895, vii, 472.

⁴ Remarks on the Changes in the Spinal Cord in Two Cases of Pernicious Anemia, Brit. Med. Jour., 1897, ii, 325; On the Spinal Cord Degeneration in Anemia, Brain, 1904, xxvii, 441.

⁵ Rückenmarkserkrankungen bei letaler Anämie, Fortschr. d. Med., xv, 569.

⁶ Über Rückenmarkserkrankung und Veränderungen bei tödlich verlaufenden Anämien, Deut. med. Woch., 1898, xxiv, 152.

⁷ Contribution à l'étude des lésions médullaires dans l'anémie perniciieuse progressive protopathique, Rev. de méd., 1897, vi, 425.

⁸ Diffuse Degeneration of the Spinal Cord, Jour. Nerv. and Ment. Dis., 1901, xxviii, i, 74.

⁹ The Relation of Some Forms of Combined Degeneration of the Spinal Cord to one Another and to Anemia, Lancet, 1898, ii, 4.

¹⁰ Klinischer und anatomischer Beitrag zum Capitel der Prognose der anämischer Spinalerkrankung—2 Fälle von anämischer Spinalerkrankung mit Dissociation der Anämie und des Spinalleidens, Mitteilung aus der Hamburgischer Staatsanstalten, 1907, ii, 1 to 7.

¹¹ A Group of Cases of System Sclerosis of the Spinal Cord Associated with Diffuse Degeneration; Occurring in Enfeebled Persons, Past Middle Life, and Especially in Women; Studied with Particular Reference to Etiology. Jour. Nerv. and Ment. Dis., 1891, xviii, 69.

¹² The Degenerative Diseases of the Spinal Cord, with the Description of a New Type, Jour. Nerv. and Ment. Dis., 1891, xviii, 205; Subacute Combined Sclerosis of the Spinal Cord and its Relation to Anemia and Toxemia, Jour. Nerv. and Ment. Dis., 1899, xxvi, 1.

tenth dorsal to the first lumbar segments on the left side there was swelling, with cavity formation, occupying almost exclusively the gray matter; patchy degeneration of the posterior columns, especially in the lower cervical region.

The patient was admitted to Bellevue Hospital, August 24, 1904, where he remained until December 13, 1904. The state of the blood during this time is shown in Fig. 1.

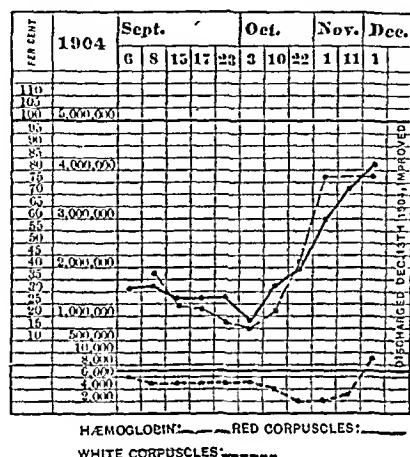


FIG. 1.—The blood chart of Case I in 1904. Microscopic examination showed the characteristic features of pernicious anemia. The highest lymphocyte count (October 3, 1904) was 37 per cent., with a polynuclear neutrophile count, on the same date, of 55.6 per cent. Normoblasts were usually present; and reached 34 in a slide on October 10, 1904. At this time 9 megaloblasts were also found, but thereafter nucleated red cells were not seen.

The following is a brief summary of the notes made on admission: A history of syphilis with initial lesion nine years previously, and excess in alcohol. Two months before admission the feet and legs swelled. Headache, dizziness on rising from recumbent position, burning pain across the abdomen, numbness in the hands and feet, and shortness of breath. Compelled on account of weakness to give up work. On examination, the diagnosis of pericarditis, chronic valvular disease, and chronic catarrhal gastritis was made, in addition to that of pernicious anemia. The stools were negative for parasites and ova. The gastric analysis showed a total acidity of 0.00073; free organic acids and salts, 0.00063; combined and free hydrochloric acid, 0.

There was nothing referable to the nervous system except persistent headache, pain over the chest and abdomen, and numbness on the left side of the body extending to the left side of the face, tongue, and lips. This latter condition occurred in paroxysms of about six minutes' duration. No objective disturbance of the nervous system was noted.

On December 13, 1904, he was discharged improved. Between

this date and January 12, when he was finally admitted to the City Hospital, he was under observation at the Metropolitan Hospital, Cornell Dispensary, and, for a brief period (one week for alcoholism) at the City Hospital. The records from these clinics show that cardiac insufficiency with valvular disease, and alcoholism with its accompanying gastro-intestinal disturbances, were the chief features. Weakness in the legs is the only note suggestive of any nervous affection. He labored in a drop-forge and coal yard and at other occupations requiring considerable muscular effort.

When admitted to the City Hospital the condition of his blood was as shown in Fig. 2.

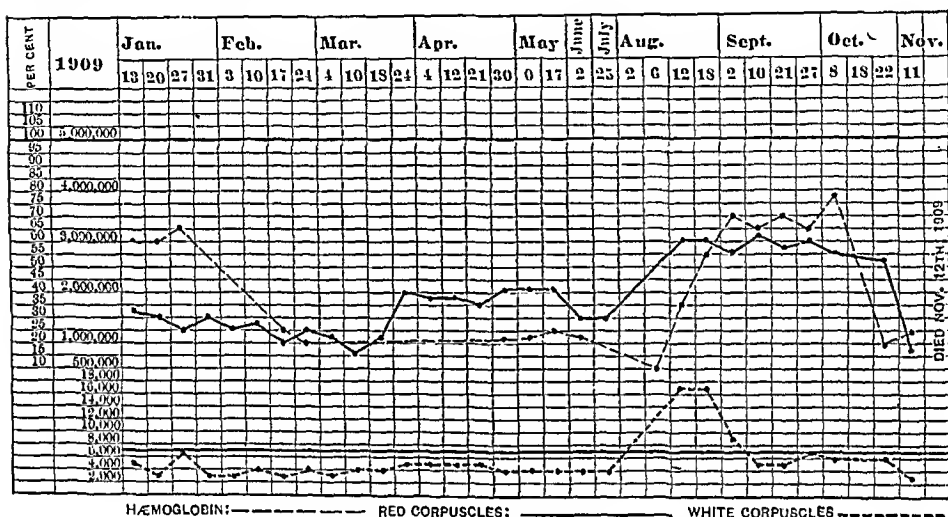


FIG. 2.—The blood chart in Case I in 1909. The microscopic examination was typical of pernicious anemia. The highest lymphocyte count was 45 per cent. (July 25, 1909); the polynuclear neutrophile count, at the same time, was 38 per cent. Nucleated red cells were a constant feature, megaloblasts preponderating.

The following is a summary of the clinical notes:

Male, aged thirty-eight years. Complains of pain in the chest, dyspnoea, dizziness, faintness, and tingling in feet and legs. History of sore tongue and bleeding gums of some months' duration. Examination showed a well-nourished man, with good amount of adipose tissue; yellowish skin. The heart showed signs of chronic valvular disease with acute incompetency. The liver and spleen were palpable. Other signs were those of profound anemia. At no time were there any symptoms or signs referable to the nervous system. The pupillary reflexes were active and knee-kick was present. No paresthesias were noted. Shortly before death the patient was walking about the ward. Up to a month before his death the blood (Fig. 2) had been steadily rising, reaching nearly as high as it did five years before, when he had been able to return to heavy labor. A month prior to death, however, the erythrocyte count fell rapidly from 3,800,000 to 1,500,000. In view of the extensive

changes in the cord found postmortem, all these clinical points are of considerable significance. Intestinal parasites or ova were not found. There was absence of free and combined hydrochloric acid.

The following notes are selected from those made between July 10, 1909 and November 12, 1909, the date of death:

July 4, 1909. Has been vomiting a great deal, takes little nourishment; restless at night; dyspnoea; moderate cyanosis; heart irregular; pallor much more marked; cheeks colorless; irrational at times; asthenia extreme; sways slightly when he walks and requires assistance, but presents no peculiarity of gait; confined to bed.

July 10. Condition gradually improving; nausea and vomiting stopped; appetite returned; cyanosis disappeared; dyspnoea slight.

August 8. Improvement more marked (Fig. 2).

August 30. Improvement steady; able to walk about unassisted; marked improvement in blood (Fig. 2.)

September 22. Six or seven fluid stools daily for two days. Temperature 102°; nothing in the physical examination to account for the temperature; no blood or mucus in the stools.

September 29. Stools and temperature normal; general condition good.

October 31. Up and about ward since note of September 29, but to-day he says he has not been feeling well for ten days; weakness, dizziness; roaring in head; precordial pain; loss of appetite; skin has undergone striking change in color (yellow); returns to bed.

November 6. Is very dizzy, even in bed.

November 11. Asthenia very marked; lemon tint of skin very marked. Patient is drowsy and he gives an expiratory grunt; answers questions rationally. There is a jugular impulse synchronous with the carotid. Cardiac impulse distinctly visible and seen over a large area, but feeble to the touch. A systolic murmur to the right of the sternum different in character from that heard at the apex. Liver does not pulsate but is readily palpable. Examination of feces negative. Urine examination showed occasional hyaline casts; faint traces of albumin; specific gravity between 1012 and 1030. Examination of gastric contents made on September 8, 1909 showed no free or combined hydrochloric acid.

November 11. The patient died.

Postmortem (ten hours after death): A well developed male, rather poorly nourished and apparently about forty years of age. The skin presented a uniform lemon yellow color. The sclerotics and external mucous membranes were not pigmented. There was a considerable degree of gingivitis and the tongue was also very furred, but neither condition appeared more marked than that commonly found at autopsy in cases which have had other causes of death. The teeth were in fairly good condition. There were no scars, skin eruptions, or hemorrhages, superficially anywhere, nor

were the surface lymphatic glands or the thyroid enlarged. The left pleural cavity contained 4 ounces of clear fluid, and the right 10 ounces of a similar fluid. The subcutaneous fat was rather less than normal in amount, and the muscles were of a bright dark brownish-red color. The peritoneal cavity contained no excess of fluid, and there was no chronic peritonitis. The pericardium contained 4 ounces of clear, straw-colored fluid and showed no evidences of pericarditis.

The heart weighed 400 grams, was soft and flabby, and all its chambers were slightly dilated. The tricuspid orifice admitted four fingers and the mitral three. There was no deformity or acute endocarditis of the valves. The right side was relatively more dilated, and the myocardium of the right ventricle was slightly hypertrophied. In the myocardium of the left ventricle, just under the endocardium and particularly near the mitral orifice was a typical thrush-breast appearance from fatty degeneration.

The lungs were slightly pigmented and cedematous. They were also uniformly somewhat emphysematous. The bronchial and mediastinal lymph glands were not enlarged.

The mesenteric and peritoneal lymph glands were all slightly enlarged and of a pinkish white-color. Microscopically they showed a considerable proliferation of the lymphoid cells, many having become somewhat swollen and often containing some brown pigment.

The intestines were somewhat collapsed throughout and were rather transparent, and their lining mucosa appeared very smooth and atrophied. Microscopically the glands were considerably degenerated and in many parts disintegrated to a considerable extent from postmortem changes. In parts also there were some small aggregations of inflammatory large mononuclear cells.

The stomach was slightly dilated, its walls thin and its lining mucosa smooth and atrophic. Microscopically this mucosa showed some considerable atrophy and degeneration of the glands, but no marked inflammatory processes.

The liver weighed 1450 grams, was very soft in consistence and of a brownish-yellow color. It gave a very marked Prussian blue reaction for iron. Microscopically it showed an extensive fatty degeneration, particularly located in the inner half of the lobules, around the central veins. In these areas the liver cells were very extensively necrotic, while those at the periphery were much better preserved. No vascular thrombosis could be observed. There was also a very marked deposit of pigment granules in the liver cells, especially toward the periphery of the lobules. The greater part of this pigment gave the reaction of hemosiderin and with prolonged staining practically all the pigment gave the Prussian blue reaction. The lining endothelium of the intralobular capillaries in occasional places showed a very marked swelling, proliferation,

and specialization, the formation of blood constituents being in these places particularly easy to observe. There was also in considerable numbers, coarsely granular eosinophile cells, with all sizes and types of nuclei, but mostly small, and with one or several nuclei like those of a normoblast. These were attached to the walls of the capillary, as a rule, but also occasionally lay free.

The bile passages were clear. The gall-bladder contained a small amount of dark, inspissated bile, but no stones.

The spleen weighed 450 grams, was considerably enlarged, soft in consistence, and dark brownish-red in color, the Malpighian bodies not appearing evident. It gave grossly a slight Prussian blue iron reaction. Microscopically it showed a rather atrophic appearance of the Malpighian bodies. The sinuses all appeared somewhat distended and for the most part contained a large proportion of nucleated cells. Some of these cells resembled megaloblasts and some, less frequently, were normoblastic in type. Many of these cells had the appearance of developing locally, rather than of being collected from the general circulation. As in the liver, with considerable frequency, coarsely granular, eosinophile cells could be seen, of all shapes, but mostly with one or several small normoblastic-like nuclei.

The suprarenal glands were considerably atrophied.

The kidneys were slightly enlarged and of a pale, brownish-yellow color. They gave a very distinct and rapid iron reaction, chiefly in the cortex. Microscopically there was a very extensive fatty degeneration of the secreting tubules, and also a very considerable deposit of iron-containing pigment.

The bladder and prostate showed no special change.

The pancreas also appeared well preserved.

The bone marrow in the centre of the shaft of the femur had a uniform, dark raspberry color. Microscopically the fat cells had almost all been replaced by a new cellular development. These new cells were mostly erythroblastic, there being megaloblasts and normoblasts in very large numbers. There was also a very considerable leukoblastic change, as there was very numerous collections of faintly acidophile myelocytes in all stages of transition. There were relatively only a very few eosinophile myelocytes.

The mastoids and tympani appeared healthy.

The cerebral meninges showed no abnormality and the vessels at the base of the brain were well preserved. The brain was firm and in good condition. It was œdematous and showed no other gross lesion. Microscopically in the cortex, in several parts examined, and in the pons, no special lesion could be observed. The medulla for the most part showed no abnormalities, but several very small patches of degeneration in the posterior columns, in the extreme lower part. The nuclei of the medulla appeared well preserved.

The spinal cord presented somewhat extensive lesions. Although the autopsy was done ten hours after death, the brain and cord were removed from the body thirty-eight hours after this. Ten c.c. of 10 per cent. formalin, however, was injected in the usual site of lumbar puncture ten hours after death.

The membranes of the cord showed no abnormality nor grossly did the entering vessels or nerves. There was no excess of fluid within the membranes, discounting the small amount of formalin injected. The cord, with the exception of a small portion, in its entire course showed no gross change, there being no shrinking, deformity or softening, and was in a good state of preservation. This exception was between the level of the tenth dorsal and first lumbar segments where, for a distance of about 2 cm., it was very

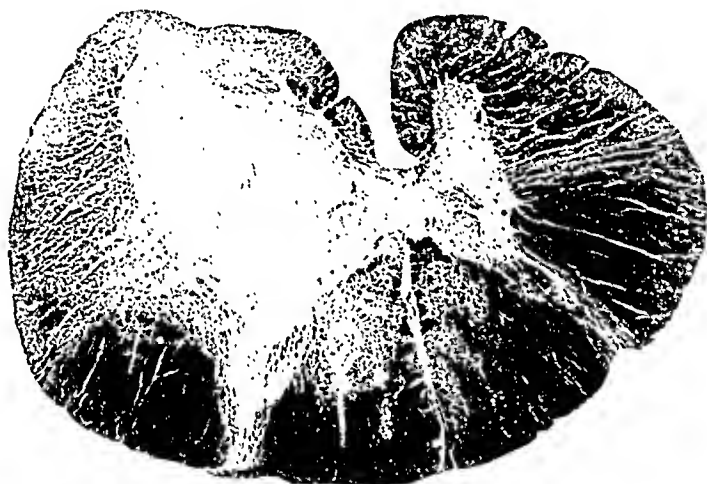


FIG. 3.—The spinal cord in Case I, showing extensive destruction of the gray matter of the left side.

much swollen on the left side. The right side, opposite this, did not appear to be affected. There was no communication externally from the interior of this swelling and no discoloration or meningeal change over it. The vessels, however, were somewhat congested on the surface of this part. On section of this swollen area, there could be seen a very extensive destruction of the cord. A large space containing a clear fluid occupied a large part of the left side in this position. This space was not surrounded by any noticeable inflammatory reaction or sclerosis, yet it was rather well defined. It occupied almost exclusively the gray matter, and the process extended between the tenth dorsal and the first lumbar segments. In the upper and lower parts there was only a very small aperture in the gray matter, on the left side, and in the deeper part of the anterior horn. This cavity formation became gradually larger until it occupied a very large part of the gray matter on the left side.

In the middle portion, opposite the twelfth dorsal segment, the gray matter was completely destroyed and the cavity extended out and laterally almost to the surface of the cord (Fig. 3). In all its length this process was located chiefly in the anterior horn, which, as the cavity became larger, destroyed it almost completely, before the posterior horn was much affected, and even when the cavity was relatively very large, the posterior part of the posterior horn largely escaped damage (Fig. 4). In all situations this lesion caused, according to the size of the cavity, a swelling of the gray matter on the left side, particularly of the anterior horn. Where the cavity grossly could not be seen, as in the upper and lower extremities of this process, the gray matter on the left side, particularly anteriorly, appeared swollen (Fig. 5).

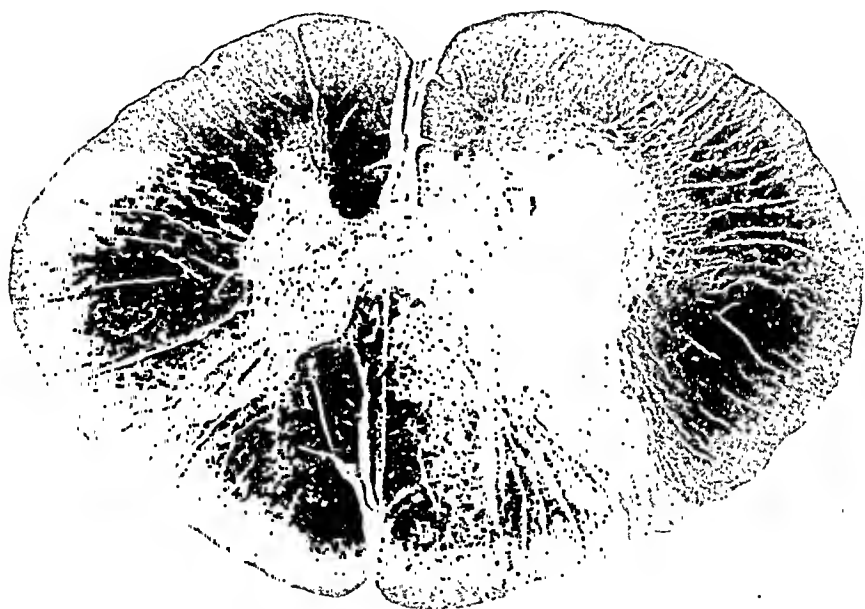


FIG. 4.—The spinal cord in Case I, showing destruction and cavity formation in the gray matter of the left side. (The specimen has been reversed.)

Microscopically there was a patchy degeneration in the posterior columns. In the lower cervical regions it affected irregularly a large portion of both Goll's and Burdach's tracts (Fig. 6). In the dorsal region the degeneration was not nearly so extensive, but there were patches in the interior of the posterior columns in the entire course of the dorsal cord and upper lumbar segments, becoming less extensive from above downward. In the sacral and lower lumbar regions, no degeneration existed. In these areas there was a disintegration of the nerve fibrils, and also a considerable amount of replacement gliosis. There were numerous large vacuoles, sometimes containing remnants of degenerated nerve fibrils. In these

same degenerate areas, however, always some healthy nerve fibrils remained and some also showing a homogeneous swelling of the myelin sheath, very often associated with disappearance or disintegration of the axon. There were, however, no evidences of inflam-

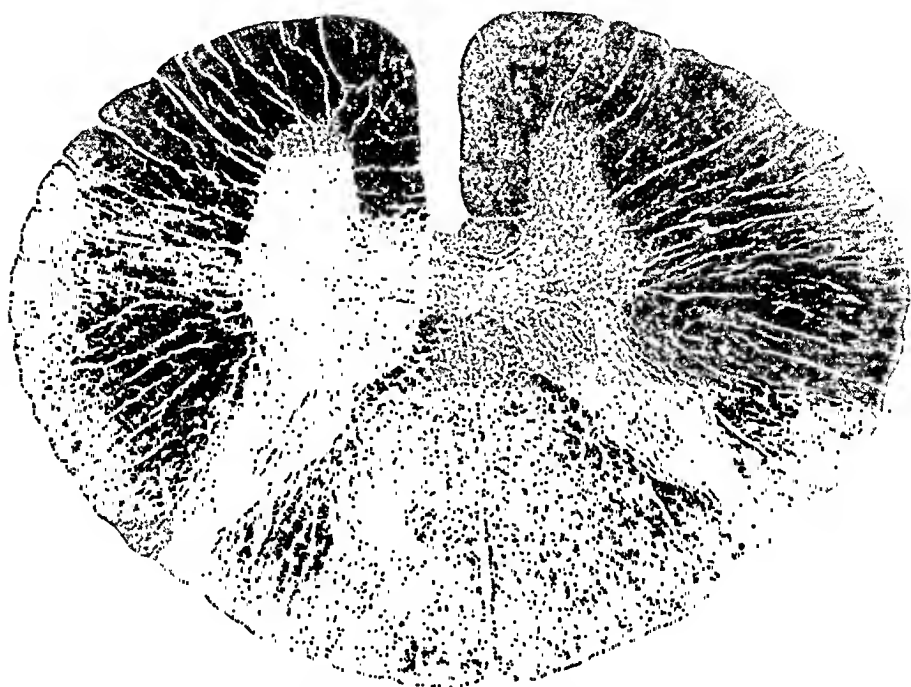


FIG. 5.—The spinal cord in Case I, showing swelling of the gray matter of the left side from oedematous separation of the tissues.

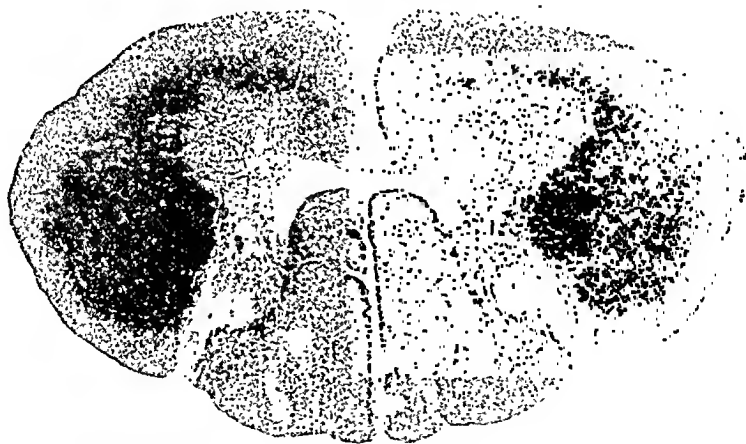


FIG. 6.—The spinal cord in Case I, showing patchy degeneration of the posterior columns.

matory reaction. The other columns of the cord showed no degenerative changes. The ganglion cells in the gray matter showed no particular change beyond perhaps a slight excess of pigment granules. In the area of extensive destruction seen grossly, the tissues seemed

more split up and distorted than necrotic. In those parts where the aperture appeared small in the gross, the tissues were simply separated apparently by fluid. There was very slight or no inflammatory reaction around the cavity. There were occasionally a few leukocytes, but no hemorrhage around or in the disintegrated part. The cavity contained only some clumps of granular debris. In the greater part of this lesion, where the cavity formation was small, the nerve cells and tissues of the gray matter were simply separated. Where the cavity was largest, the nerve cells of the entire anterior horn were largely destroyed, but this was only for



FIG. 7.—The spinal cord in Case I, showing the microscopic appearances of the gray matter in the section shown in Fig. 6. The small veins are surrounded by distended perivascular spaces and one of them is filled by a recent thrombus.

a short distance, and even in this place the cells of Clark's columns and of the posterior root were comparatively unaffected. All the vessels in the affected area on the left side were surrounded by a wide space, as if from œdema, and several of the smaller capillaries and veins, especially just above where the cavity was largest, showed recent thrombi (Fig. 7). The pial vessels in the white matter and the vessels in the gray matter at the same levels on the right side did not show any congestion or œdema. In this case, although postmortem processes may have to some extent influenced the appearances presented, yet it seemed to be the result of thrombosis of some of the small branches of the anterior spinal veins, with resulting effusion of fluid, with separation of the tissues, and some mechanical destruction of the related structures in the gray matter.

CASE II.—Under observation three years; symptoms and signs of pernicious anemia; headache; dizziness; tingling and numbness in the hands and feet for two and one-half years; six months before death there was spastic paraplegia and paresthesia; at the postmortem the characteristic changes of pernicious anemia; degeneration of the posterior and lateral columns of the spinal cord; extensive degeneration of the posterior columns and crossed pyramidal tracts, chiefly from the midcervical to the lower dorsal regions; slight degeneration of the direct pyramidal tracts.

Case II presented the symptoms and signs of pseudocombined sclerosis (Henneberg). The nervous manifestations were more or less present during the three years he was under observation, but when admitted to the New York Hospital, the diagnosis of pernicious anemia was recorded as the primary disease, and he was assigned

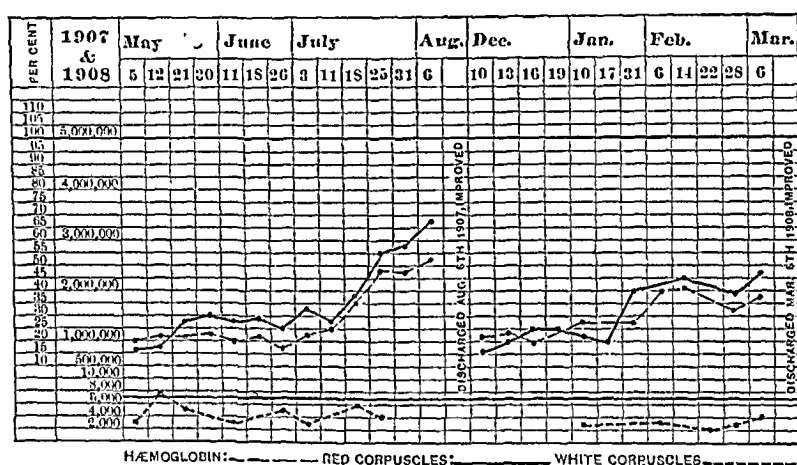


FIG. 8.—The blood chart of Case II. The microscopic examination was typical of pernicious anemia. The highest lymphocyte count was 58 per cent. (July 18); the polynuclear neutrophile count on the same date was 25 per cent. A striking feature was the absence, for the most part, of megaloblasts. Normoblasts were constantly observed, although not in great numbers.

to the Medical Division, while two and a half years later, when admitted to the City Hospital, the case was regarded as primarily neurological, and he was assigned to that division of the hospital. The postmortem examination revealed the characteristic changes of pernicious anemia, and in consequence his early record was traced.

He was admitted to the New York Hospital, May, 1907. He denied having had syphilis, but gave a history of alcohol in excess up to three or four months previously.

Fig. 8 shows the blood condition on his two sojourns in the hospitals, from May, 1907 to March, 1908. There was slight fever, the temperature ranging between 100° and 101°. There were no marked disturbances of the nervous system found during this

period. The following clinical notes are selected as indicating the condition of his nervous system at this time.

December 10, 1907. Knee-jerks not obtained.

January 7, 1908. Pain in chest, headache, tingling and numbness in hands and feet.

February 11, 1908. Taking short walks on the street.

On leaving the hospital he was able to work (hotel clerk) for three months, but had to give up on account of weakness, and a few months later he developed cramps in both legs. He was not confined to bed but sat at home, the weakness in the legs steadily increasing. This weakness continued to increase until August, 1909, when, on attempting to walk, he fell repeatedly.

In September, 1909, he was admitted to the City Hospital. On admission he was found unable to walk. Well-developed male, aged fifty-five years. Skin is lemon-color. Eyes negative; upper extremities normal. The lower extremities give exaggerated reflexes with spasticity. Skin hyperesthetic. Sensation to heat is lost below crest of ilium with exception of the inner surfaces of the thighs. The blood shows oligocythemia and nucleated red cells and anisocytosis.

November 23, 1909. Patient is drowsy and incontinent of urine. Complains of abdominal pain. Mental condition good.

December 1, 1909. Knee reflexes absent. Tactile sense greatly diminished in the lower limbs. Muscular atrophy marked and there is great loss of power. Subcutaneous oedema and numerous vesicles have appeared over both legs, and bedsores over hips and sacrum.

December 5, 1909. The patient died.

Postmortem (fifty-one hours after death): A well-nourished man, apparently sixty years of age. There was no oedema, sears, skin eruption, or hemorrhages. The skin was uniformly of a light lemon-yellow tint. The superficial lymphatic glands and thyroid were not enlarged. There was a moderate degree of gingivitis, and the teeth were considerably decayed. The superficial fat was found to be in considerable amount, and the skeletal muscles were of a dark brownish-red color. Both pleuræ were somewhat adherent posteriorly, but there was no fluid on either side. The abdomen showed no ascites or peritoneal adhesions. The pericardium contained a few cubic centimeters of a straw-colored fluid, but showed no evidence of pericarditis.

The heart weighed 425 grams, was very soft and flabby, and slightly dilated in all its chambers, particularly on the right side. There was in this case no thrush-breast appearance from fatty degeneration in the left ventricle, but the myocardium of the whole heart was evidently very considerably degenerated. The aorta and larger vessels were very well preserved. The lungs were oedematous and very emphysematous. The mediastinal, bronchial, mesenteric, and retroperitoneal lymph glands appeared pale white on section, and did not show any special enlargement.

The intestines were somewhat dilated and apparently rather

atrophic. Microscopically a very marked change was evident. The lymphoid elements were markedly hyperplastic and there were also evidences of extensive chronic inflammatory processes. The glands were largely degenerated and in many places had disappeared, their places being taken by young fibrous tissue or aggregations of large, frequently phagocytic, mononuclear cells. There was practically no pigment deposit in this situation.

The stomach was slightly dilated and its mucosa smooth and atrophic-looking. Microscopically there was considerable atrophy and degeneration of the glands, in parts also, small hyperplastic lymphoid aggregations, and also widespread subacute inflammatory processes.

The liver weighed 1600 grams, was very friable, and of a dark brownish color. It gave a very rapid and very pronounced Prussian blue iron reaction. Microscopically it showed a very widespread fatty degeneration, not being particularly localized in the central parts of the lobules, as it was in Case I. There was also a very considerable deposit of iron-containing pigment in the liver cells throughout the lobules, and also in all the tissues of the organ, including the lining cells of the vessels. In certain places the lining cells of the capillaries in the lobules were swollen, forming small groups, but no definite appearances of reformation of blood cells were observed. The gall-bladder contained a small amount of orange-colored bile, but no stones. The bile passages were free.

The spleen weighed 325 grams. It was slightly enlarged, very soft, and of a dull red color. The Malpighian bodies were not evident. It also gave a very pronounced Prussian blue iron reaction. Microscopically the Malpighian bodies were large and irregularly defined, evidently somewhat hyperplastic. All the sinuses appeared to be filled with nucleated cells. These cells were very frequently the seat of a deposit of hemosiderin. Frequently some small clumps of nucleated, hemoglobin-containing red cells of normoblastic, but more frequently of megaloblastic type, could be seen adhering to the walls of the sinuses. It seems as if there were, then, some little regeneration of blood cells taking place in these sinuses from endothelial proliferation and specialization.

The kidneys were slightly enlarged, pale, flabby, and of a pale yellow, slightly brownish color. They gave typically in their cortical parts a very bright Prussian blue reaction. Microscopically there was a very extensive fatty degeneration involving particularly the cells of the secreting tubules.

In none of these organs was there any amyloid change. The bladder and prostate were negative. The pancreas also showed no abnormalities, except slight atrophy.

The bone marrow in the centre of the shaft of the femur was dark red in color. Microscopically the erythroblastic and leukoblastic change was not so marked as in the first case, yet very largely the

fat spaces had been replaced by aggregations of regenerating blood cells. There were in these places numerous megaloblasts and normoblasts, also frequent myelocytes in all stages of transition to polymorphonuclear cells. In this case also coarsely eosinophile cells could only very occasionally be observed.

The mastoids showed no signs of suppuration.

The large vessels at the base of the brain were very well preserved and the membranes showed no abnormalities, grossly or microscopically. The brain was slightly oedematous. It showed on minute examination no gross lesion. Microscopically the cortex of the Rolandic and frontal areas, in the pieces examined, showed no special change and the internal capsule, crura, and pons, likewise.



FIG. 9. The spinal cord in Case II, showing combined degeneration of the posterior and lateral tracts; the direct pyramidal tracts are also considerably degenerated.

In the lower part of the medulla there was a slight patchy degeneration in the lateral and posterior tracts. In the region of the decussation of the pyramids, it existed only in irregular streaks, and above this no change could be seen. The nuclei of the medulla were not especially degenerated.

The membranes of the cord were in good condition, as also were the nerves and vessels relating to it. There was no excess of fluid in the spaces surrounding the cord. The cord itself was firm, and in a fairly good state of preservation. Grossly it showed no deformity or local shrinkage or softening, but there was on section a slightly darker appearance than normal of the posterior and lateral columns.

Microscopically it was evident that throughout practically the entire length of the cord there was a very extensive degeneration of the posterior and lateral columns (Fig. 9). This degeneration was most extensive in the lower cervical region, becoming less marked above this, and gradually also below it. In the sacral region, it was only very slightly evident after the first segment. In all situations it was irregular, not being confined to any well circumscribed area, and not strictly adhering to the cord tracts. The posterior column lesion was rather better defined, and apparently of older standing than was the change in the lateral columns; and the lateral column lesion became less extensive and less complete in the lumbar region than the corresponding change in the posterior columns. There were, however, degenerative changes noticeable in the lateral columns as low as the lower lumbar region. Throughout the entire length of the degeneration in the posterior columns, and especially in the dorsal region, the outer part of the column of Burdach, for a narrow strip along the posterior tract, was comparatively unaffected. The degeneration in the lateral columns did not exclusively affect the crossed pyramidal tract. The direct cerebellar and adjacent parts of Gowers' tract were generally irregularly involved. The direct, or anterior, pyramidal tract was very irregularly affected, being degenerated for short areas on one or both sides.

The degeneration in all these situations, which was characteristically irregular, appeared as a disintegration of the nerve fibers with solution of the myelin sheaths. There was thus produced a vacuolated, somewhat reticulated, appearance. Even in the most degenerated areas some unaffected nerve fibrils remained, and many fibrils also had the appearance of a solid, homogeneous body, containing no central axon. There seemed to be no inflammatory reaction in these areas and relatively only a small amount of replacement gliosis. There were apparently no hemorrhages or inflammatory changes anywhere. The gray matter was intact throughout. Many of the ganglion cells showed some slight evidence of degeneration, probably postmortem in origin, and often were somewhat overpigmented, but there were no evidences of inflammation or of hemorrhage.

The vessels of the cord in general, and in the degenerated areas showed no particular abnormality, although several of the small arteries did occasionally show a slight degree of hyaline degeneration. In no situation was any process of endarteritis found.

These two cases illustrate two of the types of nervous-system involvement occurring in the course of pernicious anemia. In the first case, which had the longest and more pronounced history of anemia, the nervous symptoms were at a minimum and the posterior columns of the cord, particularly in the cervical region, alone

showed degeneration, characteristically patchy in distribution. In the second case the nervous involvement, particularly in the later stages, overshadowed the anemia. Here the spinal cord presented very extensive, yet incomplete degeneration with slight replacement gliosis in the posterior columns, and also a similarly irregular but more diffuse degeneration in the lateral tracts, which, however, was a rather less complete and apparently somewhat more recent, process.

The nervous manifestations observed clinically in both cases did not quite correspond in severity with the extent of the pathological spinal cord lesions, a fact which has been repeatedly noted (Strümpell,¹³ Dinkler,¹⁴ etc). It bears repeating, however, that cases of combined sclerosis pass the neurologist without the gravity of the anemia which sometimes accompanies it, being appreciated. It is also true that the internist overlooks the fact that in pernicious anemia changes may be taking place in the cord, which only delicate tests by a skilled neurologist can detect. Most of the records bear out this statement.

The occurrence of changes in the nervous system, particularly what has been termed pseudocombined sclerosis, associated with pernicious anemia, has been very frequently and extensively described since the time of Lichtheim, in 1887, and has thus come to be a well recognized possible event. Such lesions in the spinal cord in pernicious anemia have been described by practically all observers, as an irregular degeneration or sclerosis in the posterior columns, with, in many cases, a similar associated process in the lateral, particularly pyramidal, tracts. Kast¹⁵ and Alt,¹⁶ however, have described local changes in the medulla in leukemia, and Dana and others have noted in the spinal cord localized areas of softening from vascular obstruction. The clinical symptom complex now termed pseudocombined sclerosis is well reviewed in the publications of Collier, Batten, and Russell,¹⁷ in 1909, and Siemerling,¹⁸ in 1909.

This combined tract degeneration as the advanced stage of nervous involvement and, at least, degenerative changes in the posterior columns, have been noted with identical appearance in a great variety of chronic, toxic, cachectic, or anemic conditions. Dana gives 10 per cent. as the number of cases described as combined sclerosis which were due to pernicious anemia. Of Taylor's¹⁹ 50 cases, 6 had pernicious anemia. Besides this there have been

¹³ Ueber eine bestimmte Form der primären combinirten Systemerkrankung des Rückenmarks, Arch. f. Psychiatrie, 1886, xvii, 217.

¹⁴ Ueber die klinischen Verlauf und die anatomischen Veränderungen bei progressiver perniciöser Anämie mit Spinalstörungen, Neurol. Centralbl., 1902, xxvi, 620.

¹⁵ Beiträge zur Pathologie der Leukämie, Ztschr. f. klin. Med., 1895, xx, 181.

¹⁶ Sectionsbefund eines Falles von Morbus Ménièrei (Leukämie), Wien. med. Woch., 1896, xvi, 919.

¹⁷ Subacute Degeneration of the Spinal Cord, Brain, 1900, xxiii, 39.

¹⁸ Rückenmarkserkrankung und Psychose bei perniciöser Anämie, Arch. f. Psychiatrie, 1909, xlv, 567.

¹⁹ Nervous Symptoms and Morbid Changes in the Spinal Cord in Certain Cases of Profound Anemia, Medico-Chirurg. Trans., London, 1895, lxxxviii, 151.

reported cases dependent on chronic ergot poisoning, Tuczec,²⁰ Redlich²¹; carcinoma, Lubarsch,²²; diabetes, Williamson,²³ Sandmeyer²⁴; septicemia and ulcerative endocarditis, Nonne²⁵; pellagra, Tuczec,²⁶ Marie,²⁷ Belmondo²⁸; lathyrism; nephritis; malaria, Mayer²⁹; shock; lead-poisoning, v. Monakow,³⁰ Oppenheim;³¹ arsenic poisoning, Dana;³² phosphorus poisoning; Addison's disease, Fleiner,³³ Brauer,³⁴ Kahlden;³⁵ tuberculosis, Summa;³⁶ syphilis; diphtheria, Bicheles,³⁷ Priesz;³⁸ typhoid fever and influenza, Redlich; scarlet fever, Billings;³⁹ chronic jaundice, Minnich;⁴⁰ chronic alcoholism, Braun,⁴¹ Nonne,⁴² Vierordt,⁴³ Redlich; leukemia, Kast, Müller,⁴⁴ Alt, Nonne,⁴⁵ Bloch and Hirschfeld;⁴⁶ bothriocephalus

²⁰ Ueber die Veränderungen im Centralnervensystem, special in den Hinterstränge bei Ergotismus, Arch. f. Psychiat. 1882, xiii, 99.

²¹ Ueber einige toxische Erkrankungen der Hinterstränge des Rückenmarks (Ergotismus, Pellagra, Infektionskrankheiten, chronischen Intoxicationen und bei den Polyncuritis, pernicioösen Anämie, Leukämie, Diabetes, Addison'sche Krankheit, etc.), Centr. f. allg. Path., 1896, vii, 985.

²² Hyperplasie und Geschwülste (Bedeutung des Carcinoms für den Gesamtorganismus), Lubarsch-Oestertag's Ergebnisse, etc., 1895, ii, 519.

²³ Changes in the Posterior Columns of the Spinal Cord in Diabetes Mellitus, Brit. Med. Jour., 1894, i, 398.

²⁴ Beitrag zur pathologischen Anatomie des Diabetes Mellitus, Deut. Arch. f. klin. Med., 1892, 381.

²⁵ Rückenmarksuntersuchungen in Fällen von pernicioösen Anämie, von Sepsis, und von Senium, etc., Deut. Ztschr. f. Nervenheilk., 1898-99, xiv, 192.

²⁶ Klinische und anatomische Studien über die Pellagra, Berlin, 1883.

²⁷ De l'origine exogène ou endogène des lésions du cordon postérieur étudiées comparative-ment dans le tabes et dans la pellagra, Sem. méd., 1894, xiv, 17, 28.

²⁸ Le alterazioni anatomiche del midollo spinale nella pellagra, Riforma med., Napoli, 1889, v, 1532.

²⁹ Oppenheim's Diseases of the Nervous System, p. 159.

³⁰ Zur pathologischen Anatomie der Bleilähmung, Arch. f. Psych., 1880, x, 495.

³¹ Zur path. Anat. der Bleilähmung, Arch. f. Psych., 1885, xvi, 476.

³² On Pseudotabes from Arsenical Poisoning, with a Consideration of the Pathology of Arsenical Paralysis, Brain, 1886, v, 456.

³³ Ueber die Veränderungen des sympathetischen und cerebrospinalen Nervensystems bei zwei Fälle Addison'sche Krankheit, Deut. Ztschr. f. Nervenheilk., 1891-92, ii, 265.

³⁴ Beitrag zur Lehre von den anatomischen Veränderungen des Nervensystems bei Morbus Addisonii, Deut. Ztschr. f. Nervenheilk., 1895, vii.

³⁵ Ueber Addison'sche Krankheit, Ziegler's Beiträge, 1891, x, 494.

³⁶ Ueber degenerative Veränderungen in Rückenmarke bei chronischer Lungenschwind-sucht, Inaug. Diss., Freiburg, 1891.

³⁷ Post-diphtheritische Lähmung (Degeneration in die Rückenmarkssträngen und hinter Wurzeln), Arb. a. d. Inst. Obersteiner Wien, 1894.

³⁸ Beitrag zur Anatomie der Diphtheritischen Lähmung, Ztschr. f. Nervenheilk., 1894, vi, 95.

³⁹ The Changes in the Spinal Cord and Medulla in Pernicious Anemia, Shattuck Lecture, Boston, 1902.

⁴⁰ Zur Kenntniss der im Verlaufe der pernicioösen Anämie beobachteten Spinalerkrankungen, Ztschr. f. klin. Med., 1892, xxi, 25, 246.

⁴¹ Ueber die experimentelle durch chronische Alcoholintoxication hervorgerufenen Veränderungen im centralen und peripheren Nervensystem, Inaug. Diss., Tübingen, 1899.

⁴² Klinische und anatomische Untersuchung eines Falles von Pseudotabes alcoholica, Jahrb. d. Hamb. Staatskrankenanst., 1892, ii, 91; Anatomische Befunde im Rückenmark bei Alkoholismus Chronicus Gravis, Deut. med. Woch., 1907, xxxiii, 166.

⁴³ Degeneration der Goll'schen Stränge bei einem Potator, Arch. f. Psych., 1886, xvii, 365.

⁴⁴ Ueber Veränderungen des Nervensystems bei Leukämie, Inaug. Diss., Berlin, 1895.

⁴⁵ Ueber Degenerationsherde in der weissen Substanz des Rückenmarks bei Leukämie, Deut. Ztschr. f. Nervenheilk., 1896-97, x, 165.

⁴⁶ Zur Kenntniss der Veränderungen an Centralnervensystem bei der Leukämie, Ztschr. f. klin. Med., 1900, xxxix, 32.

anemia, Lichtheim; tetanus, Bonome,⁴⁷ Orr and Rows;⁴⁸ after extirpation of the adrenals experimentally, Tizzoni;⁴⁹ leprosy, Looft;⁵⁰ acute insanity; etc. Such a list offers a strong evidence in support of a toxic factor as the primary agent in producing the tissue changes. Old age has also been ascribed as a cause of similar spinal cord degeneration (Sanders,⁵¹ Naka,⁵² and others), changes having been noted particularly in the posterior columns. Leyden⁵³ discussed this problem of cord involvement in old age, and concluded that it was a process secondary to some ganglion cell atrophy, rather than a primary white matter degeneration. Ribail⁵⁴ traced the condition found in certain old subjects to a thickening of the membranes with the resulting local sclerosis, and Démange⁵⁵ concluded that the spinal cord lesions in old age results from a thickening around and of the walls of the vessels which, however, causes appearances differing widely from any system of sclerosis. Nonne, in ten cases of senile marasmus, found a glial thickening and nerve fiber atrophy in the posterior columns, and to a slight extent although less definite, in the lateral tracts. He also observed a non-inflammatory thickening of the vessels limiting their lumen. It might also be mentioned, although our observations are not sufficiently numerous to be conclusive, that of the cord lesions from four extremely old and very atrophied subjects, who presented at autopsy no other lesions than extreme general atrophy and some little arteriosclerosis, none showed areas of degeneration anywhere in the gray matter of the cord. The vessels occasionally did show a slight hyaline thickening but were not surrounded by any nerve tissue degeneration or glial proliferation. The nerve fibrils as a whole, seemed somewhat atrophied, but the cords were all remarkably and relatively well preserved. The part played by defective nutrition, *per se*, in the production of degeneration in the cord is doubtful. Oppenheim denies it, and Pugibet⁵⁶ did not find any marked change in the cords of subjects dead from chronic dysentery. Experimentally, the results of attempts to produce similar degeneration in the cord, have not been uniform. Grünfeld⁵⁷ failed to produce any result on

⁴⁷ Sulla alterazione del midollo spinale nel tetano, Arch. per le sc. med., Torino, 1891, xv, 15

⁴⁸ A Clinical and Experimental Investigation into the Lymphogenous Origin of Toxic Infection of the Central Nervous System, Brit. Med. Jour., 1907, i, 987.

⁴⁹ Ueber die Wirkung des Extirpation des Nebennieren auf Kanninchen, Ziegler's Beiträge, 1889, vi, 3.

⁵⁰ Beitrag zur pathologischen Anatomie des Lepa anesthet, insbesondere des Rückenmarks, Virchow's Archiv, 1892, cxxviii, 215.

⁵¹ Alters Veränderungen in Rückenmark, Ztschr. f. Nervenheilk, 1900, xvii, 369.

⁵² Die pathologische Anatomie des senilen Rückenmarks, Arch. f. Psych., 1906-07, xlii, 604.

⁵³ Die senilen Prozesse im Rückenmarkkrankheiten, 875, ii, 42.

⁵⁴ Observations pour servir à l'histoire de l'arachnitis et de la lepto-méningite spinale chronique—sclérose médullaire secondaire, Gaz. méd. de Paris, 1885, ii, 25, 57.

⁵⁵ Contribution à l'étude des scléroses médullaires d'origine vasculaire, Rev. de méd., 1884, 753.

⁵⁶ Des paralysies dans la dysentérie et la diarrhée chroniques dans les pays chauds, Rev. de méd., 1888, viii, 110.

⁵⁷ Zur Frage ueber die Wirkung des Mütterkorns und seiner Bestandtheile auf das Rückenmark der Thiere, Arch. f. Psych., 1890, xxi, 618.

the cord by means of ergot injections. Brauer, however, obtained definite lesions in the cord as the result of alcohol administration. Von Voss⁵⁸ produced severe anemia in animals, but was unsuccessful in producing any definite cord lesions. It must then be held that any toxic process, if sufficiently severe and prolonged, may cause a degeneration in the posterior tracts or even a development of a widespread degeneration. Gordon⁵⁹ and others have made the distinction, although not widely credited, that the hemolyzed substances set free by the action of a toxin of the blood are responsible for the changes in the cord.

Clinically, from the records available, it seems impossible to associate the extent of the cord lesion with the degree of anemia. It seems, however, reasonable to infer that when the tissues are fed by the altered blood of these anemic states, a condition analogous to ischemia exists and at such times changes in the nervous system would be likely to begin or extend. It would seem, therefore, that when the blood conditions are at their severest the most critical neurological examination should be made and repeated at frequent intervals.

In the evolution of the literature of the spinal cord changes in pernicious anemia, several different pathological processes have been described as being the essential etiological factor. Thus, coalition of multiple small areas of hemorrhage to form a tract sclerosis was advocated by many of the earlier writers, Teichmüller,⁶⁰ Minnich, van Noorden,⁶¹ Petré,⁶² etc. Myelitis was the essential process according to Nonne.⁶³ Boedecker and Juliusberger,⁶⁴ Marie, Rothman,⁶⁵ etc., described it as endogenous, being the sequence of an involvement of the ganglion nerve cells. Thickening of the vessel walls with resulting defective nutrition of the cord was considered by Nonne, Minnich, Redlich,⁶⁶ and others. It has also been suggested by Schmaus,⁶⁷ and others that the immediate destruc-

⁵⁸ Anatomische und experimentelle Untersuchungen über die Rückenmarks-Veränderungen bei Anämie, Deut. Arch. f. klin. Med., 1897, lxxviii, 489.

⁵⁹ Histological Changes in the Spinal Cord in Pernicious Anemia, New York Med. Jour., 1909, xc, 80.

⁶⁰ Ein Beitrag zur Kenntniss der im Verlaufe der perniciösen Anämie beobachteten Spinalerkrankung, Deut. Ztschr. f. Nervenheilk., 1896, vii, 385.

⁶¹ Untersuchungen über schwere Anämien, Charité Annalen, 1891-92.

⁶² Bidrag till Kännedom om ryggmärgsförändringar vid perniciös anemi, Nord. Med. Ark., Stockholm, 1896, ix, No. 7, 1.

⁶³ Perniciösen Anämie beobachteten Spinalerkrankungen, Arch. f. Psych., 1893, xxv, 421; Weitere Beiträge zur Kenntniss der im Verlaufe der perniciösen Anämie beobachteten Spinalerkrankungen, Deut. Ztschr. f. Nervenheilk., 1894-95, vi, 313.

⁶⁴ Casuistisches Beitrag zur Kenntniss der anatomische Befunde bei spinaler Erkrankung mit progressiven Anämie, Arch. f. Psych., 1898, xxx, 372.

⁶⁵ Die primären combinirten Strängerkrankungen des Rückenmarks, Deut. Ztschr. f. Nervenheilk., 1895, vii, 171.

⁶⁶ Ueber eine eigenthümliche durch Gefässdegenerationen hervorgerufene Erkrankung der Rückenmarks Hinterstränge, Ztschr. f. Heilk., Berlin, 1891, xxi, 247.

⁶⁷ Zur pathologischen Anatomie der Seitensträngerkrankung bei Tabes Dorsalis, Deut. Arch. f. klin. Med., Leipzig, 1889-90, xlv, 113.

tion of the medullary sheaths and degeneration of the neuraxons is dependent on lymph stasis due to impoverished condition of the blood and its excess in lymph elements. All these various conditions could not, for obvious reasons, be responsible for the appearance found in the cord in pernicious anemia, nor could any evidences of such processes be observed in either of our two cases. Excessive fatigue is also a very doubtful factor, as it has been shown that nerve fibrils are practically inexhaustible and certainly less so than the ganglion cells or muscles. The process, agreeing with the conclusions of most modern authors, appears to be that of a degeneration with more or less replacement gliosis, and this accounts best for its irregular, imperfectly systemic, and incomplete character.

To account for the degeneration occurring especially in the posterior columns, Orr and Rows have shown that in tabetic conditions the degeneration is particularly marked at the point of entrance of the nerve roots. Also by injections of tetanus toxin and various bacterial emulsions into nerves they have demonstrated how the toxic agents ascend to the cord. They consider that the immunity of the nerves is due to the enveloping neurilemma and that only in the unprotected portion of the system where the nerve fibrils are contained in the cord, can the toxins produce any effect. It is certainly, however, somewhat difficult to apply this to either of our cases; moreover, in both of our cases the posterior roots were not altered. It seems more natural to assume a greater vulnerability to degenerative processes in certain areas of the spinal cord than in others.

In connection with these cases it has to be, to some extent, considered, just how far postmortem conditions can simulate any system lesion. These postmortem processes, however, do not produce the peculiar degenerative vacuolization nor the hyaline appearances of gliosis. In this connection the study of a series of such postmortem conditions in the cord at various intervals after removal from the body, was undertaken, with the result that system changes or appearances such as have been described were not observed.

In the consideration of the cavity formation in the lower dorsal region in Case I, there perhaps lies the one point of interest which permits of these cases being put on record. The cavity, as has been noted, was situated on the left side of the cord, between the tenth dorsal and first lumbar segments, and occupied almost exclusively the gray matter, particularly of the anterior horn. This destruction and cavity formation corresponded almost entirely to a branch of the anterior spinal artery. This vessel supplies the greater part of the gray matter, while most of the rest of the cord is nourished by the pial vessels. It was apparently a thrombosis in one of the small veins which accounted for all the œdematous separation of the tissues and the comparative absence except where the cavity was

largest, of any necrosis of tissue. This process probably was produced in the last few hours of life. It was difficult to be exact as to the duration of the process, as no clinical symptoms had been evident. The absence of clinical symptoms is explained by the location of the lesion and by the fact that the patient was comatose for some time before death.

Several examples of cases of thrombosis of the spinal cord vessels have been mentioned by various authors (Dana, Petré⁶⁸), and Hawthorne⁶⁹ has advocated that many of the cerebral and ocular complications of pernicious anemia (retrobulbar neuritis, ocular paralysis, optic neuritis, etc.) are due to vascular thrombosis. The appearances, however, described by these authors, have not been quite similar to what was found in our cases. These have been, in the majority of cases, of the nature of a hemorrhagic necrosis of the gray matter, particularly of the anterior horn. Experimentally, such conditions have also been produced by aseptic emboli, by Lamy,⁷⁰ also Ehrlich and Brieger,⁷¹ Münzer and Wiener,⁷² Singer and Münzer,⁷³ and Spronck⁷⁴ have produced similar changes by clamping the aorta in rabbits just behind the renal artery. Singer and Münzer showed in such conditions that areas of the posterior columns may become degenerated, but in our case the degeneration in the posterior tracts, besides being bilateral, was evidently of much older date than the cavity in the gray matter in the lower dorsal region.

Bullock⁷⁵ (1892) described, in a case of pernicious anemia, hyaline masses in the cord chiefly involving the anterior horns of the gray matter, and referred this to an exudation from the adjacent vessels. Henenberg⁷⁶ (1899) described two cases of combined sclerosis in which there were found cavities in the spinal cord. In one case the cavity was central and in the other it occupied the centre of one of the anterior horns. He considered thrombosis as the essential factor in their production.

The cavities in the spinal cord in syringomyelia, and the simple

⁶⁸ Fall von akuter Infektionskrankheit mit Thrombose in den spinalen Gefässen, etc., Nord. Med. Ark., 1898, ix, No. 7, 1.

⁶⁹ An Address on the Cerebral and Ocular Complications of Anemia and the Probable Relationship of These to Thrombosis, *Lancet*, 1908, ii, 857.

⁷⁰ Lésions médullaires expérimentales produites par les embolies aseptiques, *Arch. de physiol. norm. et pathol.*, 1897, ix, 184.

⁷¹ Ueber die Ausschaltung des Lendenmarksgrau, *Ztschr. f. klin. Med.*, 1883, vii, Supp. Heft, 155.

⁷² Beiträge zur Anatomie und Physiologie des Centralnervensystems, *Arch. f. exp. Path. u. Pharmak.*, 1895, xxxv, 113.

⁷³ Beiträge zur Anatomie des Centralnervensystem, *Akad. d. Wissenschaften, Wien, Denkschriften*, 1890, lvii.

⁷⁴ Contribution à l'étude expérimentale des lésions de la moelle épinière déterminées par l'anémie passagère de cet organe, *Arch. de phys. norm. et pathol.*, 1888, 389.

⁷⁵ Hyaline Degeneration in the Spinal Cord, *Brain*, 1892, xv, 411.

⁷⁶ Beitrag zur Kenntniss der combinirten Strängdegeneration, sowie der Höhlenbildung im Rückenmark, *Arch. f. Psych.*, 1889, xxxii, 550.

serous cysts which from time to time have been described in the cord and brain, may, some of them at least, be possibly of similar origin. Again, certain cases of pernicious anemia have been described as terminating with fulminating and intense nervous symptoms, and in these the occurrence of multiple thrombi and resulting extensive cord destruction is very probable.

A hemorrhage into the spinal cord, such as might easily occur in pernicious anemia, might, of course, produce localized paralytic symptoms, as a case reported by Riggs,⁷⁷ but it would be likely to have the definite location and completeness of destruction of an embolism or thrombosis.

Had Case I, of the two here reported, survived, the final result would probably have been exactly like acute anterior poliomyelitis. It seems, moreover, peculiar that such conditions do not more frequently occur, particularly in various states of defective vitality or in the course of some general infective process.

⁷⁷ Paraplegia Arising from Hemorrhage into the Spinal Canal, due to Pernicious Anemia, *Jour. Nerv. and Ment. Dis.*, 1896, xxi, 554.

REVIEWS.

MODERN MEDICINE. ITS THEORY AND PRACTICE. IN ORIGINAL CONTRIBUTIONS BY AMERICAN AND FOREIGN AUTHORS. Edited by WILLIAM OSLER, M.D., Regius Professor of Medicine in Oxford University, England; Assisted by THOMAS McCRAE, M.D., Associate Professor of Medicine and Clinical Therapeutics in the Johns Hopkins University, Baltimore. Vol. VII; pp. 969; 37 plates and 12 text illustrations. Philadelphia and New York: Lea. & Febiger, 1910.

THE seventh and concluding volume of Osler's *Modern Medicine* is devoted to a consideration of diseases of the nervous system. It includes a wide range of topics, all of which are ably handled by well-qualified authors, as follows: An introduction, by Lewellys F. Barker; diseases of the motor tracts, by William G. Spiller; combined system diseases, by Colin K. Russell; sclerosis of the brain and diseases of the meninges, by Edwin Bramwell; diffuse and focal diseases of the spinal cord, by E. Farquhar Buzzard; topical diagnosis of diseases of the brain and aphasia, by Joseph Collins; diseases of the cerebral bloodvessels, by Henry M. Thomas; tumors of the brain and meninges and hydrocephalus, by Harvey Cushing; diseases of the peripheral nerves, by Gordon M. Holmes; diseases of the cerebral nerves, by E. W. Taylor; paralysis agitans, chorea, choreiform affections, and infantile convulsions, by D. J. McCarthy; acute encephalitis and brain abscess, by E. E. Southard; syphilitic and parasyphilitic diseases of the central nervous system, and amaurotic family idiocy, by Bernard Sachs; neurasthenia, and the traumatic neuroses and psychoses, by Charles W. Burr; and migraine, neuralgia, professional spasms, occupation neuroses, tetany, and hysteria, by Smith Ely Jelliffe.

Critical comment of all these subjects is altogether out of the question within the available space; but fully conscious of the excellence of a number of articles not again specifically mentioned, one may perhaps direct special attention to several of much importance. Thus, for instance, Barker, in his introductory chapter, discusses in an illuminating manner the senses and their symptomatology; disturbances of sensation; anomalies of sense perception; disturbances of complex psychic processes, of motility, and of coördination; and anomalies of speech and writing, of reflexes, and

of vasomotor, secretory, and trophic functions. Altogether the chapter is an example of careful writing and clear reasoning, and it is replete with information of a diversified but related nature, the details of which are here brought together and rendered available.

Spiller's chapter on diseases of the motor tracts comprises a lucid and accurate account of progressive spinal muscular atrophy, progressive spinal muscular atrophy of childhood, amyotrophic lateral sclerosis, lateral sclerosis, hereditary spastic spinal paralysis, unilateral ascending and unilateral descending paralysis, progressive neural muscular atrophy, interstitial hypertrophic neuritis of childhood, progressive bulbar palsy, and muscular dystrophy. All of the discussions bear the imprint of Spiller's well-known care and painstaking, his thorough knowledge of the subject, and his efforts to explain clinical phenomena in terms of anatomical lesions. For instance, he discusses amyotrophic lateral sclerosis as apart from progressive spinal muscular atrophy and from chronic or subacute poliomyelitis. Bramwell has enhanced the value of his chapter on diseases of the meninges by a short but excellent section on lumbar puncture and the examination of the cerebrospinal fluid. Buzzard, in his chapter on diffuse and focal diseases of the spinal cord, discusses the localization of non-systemic diseases of the cord and the cauda equina, and illustrates the practical application of the information thus imparted in the diagnosis of compression and tumors of the spinal cord. His discussion of the symptomatology and diagnosis of tumors of the cord well repays careful reading, and should lead to an early diagnosis of these growths—at a time when many of them are amenable to surgical procedures. Of Collins' chapter on the topical diagnosis of diseases of the brain, one can well say it is worth the reading; the information therein contained is essential to an accurate diagnosis of irritative and destructive lesions, and it is so presented as to be readily comprehended by those less well informed than its author. This may also be said of Collins' chapter on aphasia, wherein one finds a thorough and critical discussion of the current opinions on the intricate subject of aphasia, as well as of the revision of the subject proposed by Marie.

Thomas, among other subjects, discusses the important condition of apoplexy. He uses the term in what he describes as its original symptomatic sense—"to strike off or be disabled by a stroke;" and he includes therein cerebral hemorrhage, thrombosis, and embolism. The article, which comprises seventy-one pages, is one of the most valuable in the volume, and is embellished by a number of statistics, especially those relating to 740 patients studied at the Johns Hopkins Hospital. Harvey Cushing's chapter on tumors of the brain and meninges is especially important and valuable, since it has been contributed by one who has achieved an international reputation in cerebral surgery and is a record of personal observation and study of 136 cases.

As syphilitic and parasyphilitic diseases of the nervous system, Sachs includes cerebrospinal syphilis, acute and chronic specific myelitis, syphilitic spinal paralysis (Erb's type), tabes dorsalis, and general paresis. There can be but little adverse comment in including tabes dorsalis as a syphilitic disease, although writers now and then report cases in which syphilis can or seems to be excluded. Sachs himself has seen only one case in which he was certain of the absence of syphilis, and since the use of the Wassermann reaction the demonstration of syphilitic infection in cases that otherwise would have passed as non-syphilitic is becoming common. Burr's contribution on neurasthenia and the traumatic neuroses and psychoses needs to be read to be appreciated; no one who reads the chapter will for a moment doubt what the author means, and, what is perhaps the greater compliment, he will almost always agree with him.

Smith Ely Jelliffe contributes fifty-seven very interesting pages on hysteria. Herein one will find at least mention of the many and varied opinions and divers writings that have illuminated (and clouded) the subject from pre-Christian to the present times—the views of the Charcot school, the studies of Pierre Janet, Freud's hypotheses and accentuation of the sexual basis of the hysterical phenomena, Babinski's ideas especially concerning the suggestibility of the manifestations, and much more, including some illuminating ideas and comments by the author himself. It is interesting to some of us to read: "In practice it may take months or years to fully analyze some hysterical cases. When fully analyzed, the patients become cured—the analysis has been a catharsis." The discussion of the treatment of hysteria is excellent, and should be read by general practitioners.

The work is done; three years have elapsed between the publication of the first and the seventh volumes—a record of which the editors and the publishers may well be proud. Commenting upon the first volume, we said that it was well conceived, excellently planned, and splendidly executed; we have entertained a similar opinion as each succeeding volume has come to hand, and now that the work is finished we are finally confirmed in the opinion. The many contributions that go to make up the seven volumes attain a high average level; there are very few, if any, that are mediocre; many are of unusual excellence and in the broadest sense authoritative. The work as a whole is a repository of our knowledge of the present state of medicine; the plan of the editor who designed the work primarily for the practitioner who wishes to keep himself informed of the existing state of our knowledge in clinical medicine has been fulfilled; so that we may say of the entire work, as we did of the first volume, it may be warmly recommended to the physician as replete with the practical applications of science to medicine, mirroring the clinical manifestations of disease, and helpful and resourceful in suggestions for treatment.

A. K.

THE MALARIAL FEVERS, HEMOGLOBINURIC FEVER, AND THE BLOOD PROTOZOA OF MAN. By CHARLES F. CRAIG, M.D., Captain, Medical Corps, U. S. Army. Pp. 477; 4 colored plates, 25 clinical charts, and 28 photomicrographs and drawings. New York: William Wood & Company, 1909.

THE discovery of the true cause of malaria by Laveran gave renewed impetus to the study of this infection. As a result, there has grown up during the past thirty years an extensive literature upon all phases of malaria. However important much of this literature may be, a large part of it is of necessity inaccessible to the majority of practitioners, especially to most English speaking ones. Yet, as our invasion of the tropics goes steadily forward year by year, the ever-increasing importance of the malarial infections makes it essential that the facts discovered by so many able workers in this field should be squarely placed before the entire medical profession. To review critically the work of others and to set forth clearly our modern conception of malaria is an undertaking only to be assumed by one conversant with the literature and at the same time familiar with the clinical aspect of the subject through wide personal experience. It is fortunate, therefore, that this difficult task has been undertaken by so painstaking a student of malaria as Dr. Craig, whose experience in dealing with over 5000 cases of malaria of all forms in various parts of the world has rendered him competent to write with authority upon the malarial fevers.

Craig divides the malarial plasmodia into four distinct species: (1) *Plasmodium malarix* (quartan parasite); (2) *Plasmodium vivax* (tertian parasite); (3) *Plasmodium falciparum* (tertian estivo-autumnal parasite); and (4) *Plasmodium falciparum quotidianum* (quotidian estivo-autumnal parasite). In view of the controversy and confusion which exists as to the classification of the malarial parasite, it is interesting to note that Craig unhesitatingly states that there are two distinct species of estivo-autumnal plasmodia, the tertian and quotidian.

He devotes the first part of the book to the general question of etiology, but more particularly to a consideration of the morphology and development of the plasmodia within man and the mosquito. The detail with which he enters into the differentiating characteristics of the various species of malarial organisms when found in human blood should make it possible for even the inexperienced student to recognize the different forms of infection. Unlike some observers, he holds that the sporogenic forms of the plasmodia, the gametes, are not introduced as such by the infected mosquito, but arise within the human blood after the asexual forms have sporulated for some time. He refutes and dismisses as worthless all evidence which attempts to show that malaria is transmitted

to man in any way save by the bite of infected mosquitoes. Further, he denies the existence of congenital malaria, and states that infection of the foetal portion of the placenta by malarial parasites does not occur.

After devoting several chapters to a careful review of the pathology of malaria, he enters upon the discussion of the clinical aspects of the subject. He opposes the usual clinical classification of the malarial fevers into intermittent, remittent, and continuous, on the ground that any variety of malarial infection may exhibit any one of these three types of fever. He prefers to divide malaria clinically according to the variety of the infecting parasite, thereby doing away with much confusion by bringing into accord the clinical and etiological classifications of malaria.

In speaking of pernicious malaria Craig follows the usual custom of designating the various forms according to the symptoms which preponderate. He makes it clear, however, that pernicious malaria is not a separate disease due to any particular species of plasmodium. He emphasizes the fact that any of the forms of malarial parasites which are capable of causing the mildest types of infection, may, under favorable conditions, give rise to the rapidly fatal pernicious forms of malaria. The frequency of latent malaria, a form of infection in which some type of the plasmodium is found in the blood of individuals who exhibit no symptoms of the disease, is shown by the author's experience. He found that out of 1297 cases of malaria in Americans, 307, or nearly 24 per cent., were latent infections. The importance of recognizing such cases from the standpoint of prophylaxis becomes at once apparent.

It is well known that primary malarial infections are prone to recur. How these recurrences are brought about, in the absence of any reinfection, has occasioned considerable controversy. As a result of careful study, Craig has made some interesting observations upon this point. He has been led to conclude that within the blood of man malarial infections are perpetuated and hence tend to recur, through a process which he terms intracorpuseular conjugation. Briefly, this consists in "the complete and permanent union of two unpigmented plasmodia within the red blood corpuscles." The process is similar to conjugation as observed at some period in the life cycle of nearly all protozoa, the purpose of which is the restoration of the property of reproduction in an exhausted organism.

The chapters dealing with prophylaxis and treatment, although carefully prepared and well written, contain little that is not already well known. The personal observations of the author upon the changes induced by quinine in the different species of malarial plasmodia are noteworthy. Throughout the discussion of treatment his dictum is that success in treating malaria depends more upon the manner in which quinine is given than upon the quantity of the drug administered. He strongly advocates the prolonged

administration of quinine in divided doses rather than the method of giving a single massive dose before the expected paroxysm.

The closing section of the book is devoted to a consideration of the blood protozoa in man other than the plasmodium of Laveran, and of hemoglobinuric fever. In regard to the latter disease the author is emphatically opposed to the theory that it is due either to malaria or to quinine. He looks upon hemoglobinuric fever as "a disease *sui generis*, caused by a hitherto undiscovered organism, probably of protozoal nature."

Throughout the book one is impressed by the fact that the author's large experience with the disease has enabled him to form an individual opinion upon nearly all questions of importance. Whenever his observations are at variance with those of other workers he has the courage uncompromisingly to state his position. The work contains only the typographical errors to be expected in a first edition. Some of those noted occur on pages 93, 102, 218, 223, and 231. The value of the book as a work of reference is greatly increased by the bibliographies appended to each chapter. There is no question that an enormous amount of painstaking labor has been expended in gathering the material which forms the basis for most of the author's statements. Dr. Craig has furnished the profession with an extremely useful and at the same time interesting book upon a subject of increasing importance. If his efforts meet with the widespread recognition which is his due, it is safe to predict that many of the vague uncertain conceptions of the malarial fevers still held by some persons will be radically altered, much to the benefit of many communities.

G. M. P.

OPERATIONS UPON THE UTERUS, PERINEUM, AND ROUND LIGAMENTS. By W. J. STEWART MCKAY, M.B., M.CH., B.SC. Senior Surgeon, Lewisham Hospital for Women and Children. Pp. 454; 148 illustrations. New York: William Wood & Co., 1909.

THIS is a well-printed and most profusely and handsomely illustrated book. The title is, however, somewhat misleading, since the operations upon the uterus consist merely of eurette, of those procedures aiming to correct a retrodisplacement, and the operative treatment of dysmenorrhœa. The volume opens with a lengthy chapter upon the anatomy of the vulvoperineal region, together with a discussion of the choice of operative procedures for the repair of the injuries of this region. The author believes in the H-shaped operation of Tait for the repair of complete tears and in Emmet's method for lesions of the vaginal sulci, unless there be marked rectocele, when the Hegar is advised. In discussing the

repair of complete rectal tears, he says that "this accident is very serious and must be attended to at once, otherwise the patient will have no control of her motions." In parentheses we may be forgiven for saying that we object to the last word in the passage quoted, believing that there are several better ones in the English language. A more important criticism, however, relates to the alleged necessity for immediate repair; in a rather extensive experience we have learned that immediate operation is not a necessity, and we are entirely convinced that if it is deemed inadvisable to repair without ether, it is better to wait for several days, since there is no question that to give an anesthetic immediately after placental delivery is dangerous practice. Moreover, a tired woman, tired doctor, poor light, and inefficient assistants do not tend to the production of good surgery. We have been greatly interested and surprised to note that the author advises that ether be given to remove vaginal stitches. We cannot imagine any possible reason for advocating this as a routine; we have never been obliged to resort to anesthetics for the removal of either the cervical or vaginal stitches, and we consider that it is unjustifiable.

In the description of the operative relief of cystocele we note a mistake due to oversight, the author stating, upon the authority of Hirst, that the deep transversus perinei is the strongest support of the anterior vaginal wall. The muscle of the urogenital trigonum, described by Waldeyer, and upon the importance of which Hirst always lays great stress, is of course the muscle meant by the author. We are sorry that we are unable to refer to this section with any degree of satisfaction. The description is meagre and the operative treatment advised is antiquated and inadequate. In his consideration of the repair of cervical injuries, a satisfactory exposition, we are again met with the astounding statement that "to remove them [that is, cervical sutures] an anesthetic should always be administered." The immediate repair of cervical lacerations is, we are glad to see, strongly advised against, as is also any operative procedure for the repair of old perineal lacerations during the lying-in period.

While not agreeing with certain minor points in his operative technique, we take pleasure in commending the chapter, of over one hundred pages, upon displacements of the uterus. The succeeding chapter upon uterine curettage is, in general, satisfactory, though we do not fancy the delay in emptying the uterus, advised by the author, in cases of inevitable or incomplete abortion, as we feel that repeated tamponade predisposes to sepsis. The next chapter is devoted to a consideration of curettage of the uterus; over one hundred pages are devoted to this subject, none too many, and it is a very satisfactory thesis, except for a footnote to page 396, in which the author states that in treating a case of streptococcic infection he transfused blood from the husband. Upon

the basis of this one case he draws the conclusion "that fresh blood transfused will stop the rigors and reduce the temperature of puerperal septicemia." Aside from the fallacy of forming his judgment upon entirely insufficient data, we feel that the author, in the light of recent investigations, has made an unfortunate statement.

The volume closes with a chapter comprising two pages and four illustrations upon dysmenorrhœa. The author advocates the splitting of the posterior cervical lip as the best treatment for obstructive dysmenorrhœa, the only variety categorically mentioned except that due to posterior displacements of the uterus. We cannot honestly say that we think that this book is necessary to the advancement of medicine or that it is the best exposition of the limited portion of gynecology of which it treats.

W. R. N.

SURGICAL DIAGNOSIS. By ALEXANDER BRYAN JOHNSON, Ph.B., M.D., Professor of Clinical Surgery in the Columbia University Medical College, New York. Three volumes (pp. 810, 777, 810); 5 colored plates, and 784 illustrations in the text. New York and London: D. Appleton & Co., 1909.

THIS ambitious work on *Surgical Diagnosis* is dedicated "To Doctor Charles McBurney, the greatest surgical diagnostician the author has ever known;" it "embodies to some extent the impressions gained during an experience extending over a period of nearly twenty-five years;" and in preparing it "the author has had constantly in mind the needs of the *practitioner of general medicine*, and it is to him especially, he believes, that this work will be found valuable."

The subjects in Vol. I are treated in the following order: Wounds, infections, joints, bones, soft parts, tumors, fractures and dislocations, syphilis, leprosy, bloodvessels, x-rays, head, brain, ear, mouth (no eye), neck, œsophagus, thorax, breast, abdomen, and peritoneum; Vol. II, stomach, intestines, appendix, liver and biliary passages, spleen, pancreas, rectum, hernia, kidney, ureter, bladder, and genitals; Vol. III, spine and spinal cord, nerves, pelvis, shoulder, arm, elbow, forearm, wrist and hand, hip, thigh, knee, leg, foot and ankle. In an Appendix are included various matters, among which may be mentioned additional notes on polycystic kidney, rabies, parathyroid glands, *Spirochæta pallida*, acute rheumatic fever, exophthalmic goitre, operative indications in benign diseases of the stomach, lesions of the brain, gunshot wounds, serum diagnosis of syphilis, and status lymphaticus—in the remarkable succession named.

The volumes are exceedingly inclusive and tediously diffuse;

minute directions for blood examinations are given, and bacteriological methods and gastric and urinary analyses of extreme complexity are described in their utmost details. Much of this matter, we believe, should have been omitted; the tests cannot be made by the general practitioner himself, but only by trained pathologists, and these will not look for aid to a work on surgical diagnosis professedly written for the use of the former. Moreover, all these methods are quoted, often *verbatim*, from other books or recent journal articles.

The author is at his best when dealing with purely clinical diagnosis, in which, from his large experience, he has become an adept, and a worthy pupil of his skilled master. An effort has been made to include enough pathological data to be of service in making a true diagnosis; for the author seems to recognize that without a knowledge of the underlying pathological processes diagnosis is frequently a matter of happy (or unhappy) guesswork. In the first and second volumes he keeps to his subject of diagnosis with fair constancy; but in the third volume there is evidenced a tendency to discourse on therapeutics, which, so far as we can see, serves no other purpose than to fill an unnecessary number of pages; thus, an entire page is devoted to the *operative treatment* of fracture of the patella, another entire page to the treatment of fractures of the tibia, and two pages to the operative treatment of gastric lesions; and throughout the three volumes numerous case histories are quoted at length, which have much more interest from considerations of prognosis and treatment than from those of diagnosis.

The work gives the impression of having been written for the mere sake of writing a book, of making it as large as possible, and of using as many as possible of a large collection of illustrations assembled through many years by the author, his colleagues, and friends. The figures do not always appear to have been chosen with a view to elucidating the text, and in a number of instances the author has been unable in any way to bring the subject illustrated in the figures into his text, no reference to them, not even a remote reference, being discoverable. Yet many of the figures are very apposite illustrations of the text; and if only the author had not been swamped with his material, or if he had made illustrations to explain the text, instead of attempting unhappily to construct a book around the illustrations, the result would have been more satisfactory. There is a series of 32 figures of museum specimens (dried bone) of healed fractures of the humerus; yet the author has to apologize, in his text, for inability to use more than a "fraction" of the total number of specimens of this kind which were placed at his disposal. But there is no further reference in the text to this series of figures, which are of infinitesimal value for the purposes of diagnosis. Their places could well have been taken by five or six skiagrams of typical fractures before reduction.

The amount of space devoted to the various sections of the work is not always in relation to their importance. While the lesions of the liver, gall-bladder, pancreas, and spleen are discussed in less than 75 pages, no less than 216 pages (13 chapters) are devoted to the kidney and ureter, and 220 pages (14 chapters) to the bladder and genitalia. The female genitalia are not included.

Some of the chapters have a bibliography appended (for no apparent reason, as others have not), and each volume has at the end an alphabetical list of the authors cited, as well as an index; while the third volume has general indices to the whole work. It is interesting to see, in the general index of authors, that the writer of the volumes is cited as an authority no less than four hundred and sixty-four times, the mere list of references to the pages where he is quoted occupying nearly an entire page of the index; those to whom the volumes are addressed surely will emulate the rustics of whom Goldsmith wrote:

"And still they gazed, and still the wonder grew
That one small head could carry all he knew."

The work, we believe, could be condensed into two volumes, possibly into one large volume, with advantage; the laboratory tests could be omitted altogether; the case histories and the long *verbatim* quotations from recent journal articles might be given in abstract; and with efficient editing (which the volumes have not had) and rearrangement of the subject matter the work would assume a form much more apt to be received favorably by the profession.

A. P. C. A.

A TEXT-BOOK OF THE PRACTICE OF MEDICINE. By JAMES M. ANDERS, M.D., Ph.D., LL.D., Professor of Medicine and Clinical Medicine in the Medico-Chirurgical College, Philadelphia. Ninth edition; pp. 1326; 82 illustrations. Philadelphia and London: W. B. Saunders Company, 1909.

THE new edition of Dr. Anders' *Practice of Medicine* represents a thorough revision of those that have gone before. Obsolete matter has been eliminated, and matter that means progress has been incorporated. A list of new or rewritten matter, were it printed, would be long; it comprises minor or major changes and additions to almost every page of the book. The section on tropical diseases has been enlarged. Having reached a ninth edition, the book, of course, is one of the standard volumes of the subject of which it treats. A. K.

PROGRESS OF MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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The Cultivation of Tubercle Bacilli Directly from the Sputum by the Use of Antiformin.—The fact that the cultivation of tubercle bacilli directly from the sputum has never been an easy task makes any new method unusually interesting. BROWN and SMITH (*Jour. Med. Research*, Boston, 1910, xxii, 517) have made use of antiformin. The technique is very simple. Equal parts of 30 per cent. solution of antiformin in water and the sputum were thoroughly mixed in a sterile tube and then centrifugalized, the supernatant fluid decanted, and the sediment mixed with sterilized distilled water. This process was repeated three times. The sediment was then scattered over the surface of Dorset's egg medium and placed in the incubator. The results are summarized as follows: Of 50 specimens of sputum examined, 35 showed tubercle bacilli on microscopic examination. Positive cultures were contained in 33, or 97 per cent. of these 35 specimens, and in 4 of 15 specimens in which no tubercle bacilli were found microscopically. Guinea-pigs inoculated with these 37 cultures developed tuberculosis in every instance.

An Investigation of the Acid-fast Bacteria Found in Human Feces, with Especial Reference to their Presence in Tuberculosis.—In reviewing the literature on this subject, ALEXANDER (*Jour. Hygiene*, 1910, x, 37) finds it well established that acid-fast bacilli may be present in the feces in cases of pulmonary and intestinal tuberculosis, and that their presence, though in relatively large numbers, does not necessarily imply ulceration of the intestine. However, it has not been shown that these acid-fast bacilli are tubercle bacilli. The author injected subcutaneously into guinea-pigs, of the average weight, human feces in the average amount of 0.02 gram. He found that this was the largest amount that could with safety be injected. The feces of 23 cases of pulmonary

tuberculosis in which acid-fast bacilli had been demonstrated by the microscope were proved capable of infecting guinea-pigs with tuberculosis. An examination, microscopically, of 129 samples from non-tuberculous individuals revealed no acid-fast bacilli. From this we would infer that all acid-fast bacilli in the feces are tubercle bacilli. He emphasizes the fact that it is more difficult to demonstrate tubercle bacilli in constipated than in diarrhoeal stools. In 74 cases the bacillus was demonstrated 52 times. These cases included bone, joint, meningeal, skin, glandular, pleural, pulmonary, and miliary tuberculosis.

An Experimental Study of the Blood Serum in Uremia.—CAWADIAS (*Comp. rend. Soc. de biol.*, 1910, lxxviii, 976) has injected the blood serum of uremic patients into the peritoneal cavity of rabbits and produced immediately such phenomena as convulsions, paralyses, dyspnoea, hypothermia, even death. Normal serum will produce toxic symptoms, but much larger doses are necessary than of the serum of a uremic patient. Even the sera of uremic patients vary in toxicity, the serum of a uremic in convulsions being high in the scale. Cawadias emphasizes the fact that the serum of a well individual differs from that of a uremic only in degree of toxicity. The results of injection are the same if only the right amount is used. The conclusion is drawn that in uremia there is no new poison, but a preëxisting toxic substance whose action becomes more intense.

Fixation of the Complement in Hydatid Disease.—CHAUFFARD and VINCENT (*Bull. et mém. de la Soc. méd. d. hôp de Paris*, 1910, xxvii, 859) report a case of hydatid cyst of the liver with eosinophilia, in which the fixation of the complement failed. The history pointed to a duration of three years. The eosinophilia disappeared the evening of operation, whereas, eleven days later the reaction of the fixation of the complement was positive. Chauffard and Vincent conclude that there are cases of hydatid cysts (1) with all biological reactions positive, both eosinophilia and reaction of fixation. As a rule, the eosinophilia disappears after operation. On the other hand, cases (2) occur in which these reactions are negative before operation but appear after it. Finally, there exist (3) intermediary types with incomplete or dissociated reactions. They are of two forms—reaction of fixation positive without eosinophilia, and the opposite. After operation the positive reaction disappears and the negative becomes positive.

The Specific Treatment of Carcinoma.—COCA and GILMAN (*Philippine Jour. Science*, 1910, iv, 391) have used a vaccine in the specific treatment of carcinoma. This was prepared as follows: The tumor tissue, immediately after excision, was cut up with scissors and passed ten times through a vaccine grinder which had been sterilized by successive rinsing through pure carbolic acid, absolute alcohol, and sterile salt solution. After the first passage through the grinder an equal amount of sterile salt solution was added. By thorough grinding of the tissue, practically all the tumor cells were completely broken up, so that the decanted fluid contained all the protoplasm and nuclear substances of these cells. In order to get rid of the shreds of fibrous tissue the thick creamy fluid was centrifugalized at a high speed for three

minutes and decanted. The injection was made preferably within six hours after the addition of the carbolic acid, which was made in the strength of 1 c.c. of 5 per cent. carbolic acid to every 10 c.c. of fluid. This was an antiseptic measure. The largest amount injected at one time was about 20 to 25 grams. The degree of local reaction of the tissues to the injection has varied from absolutely none whatever in a case of Hodgkin's disease to abscess formation in two cases of carcinoma. One of these abscesses was sterile. In 3 cases affected with carcinoma, such injections have been followed by a softening and disappearance of tumor masses measuring in diameter from 2 to 4 cm. In the fourth case a rapidly growing lump, which had appeared in the site of an excised cancer two days after treatment, was shown a week later to be a firm encapsulated mass of dying epithelial-like cells. Three other surgically inoperable cases have remained from five weeks to six months free from recurrence of disease. Seven other cases have remained free from a return of the disease for from one to seven months. Two of these were designated as curable by operation, three as probably curable, and two as of doubtful curability. In only one case has disease returned after treatment. Here the material used for vaccine was rendered inert by too vigorous disinfection. Large injections of tumor material seem to cause a rapid disappearance of cachexia. The efficacy of the treatment is indirectly proportional to the amount of malignant tissue left in the body, and within certain limits directly proportional to the amount of tumor cell substance injected and to the number of injections made. Apparently carcinoma in one individual may be successfully treated with injections of material from a carcinoma of the same kind taken from another individual. At any rate, the protoplasmic substance of moderately malignant epithelial tumors in human beings can be injected subcutaneously in large quantities with no injurious results.

A New Remedy for Ankylostomiasis.—WIJN (*Janus*, 1910, v, 178) in Java has found a new remedy for hook-worm infection. His prescription is: Oil of eucalyptus, 2.5; chloroform, 3.5; castor oil, 40. This dose is taken on an empty stomach in the morning and is to be repeated in two hours. The treatment may be repeated three times in a week, if necessary. A dose of castor oil should be given the day preceding the treatment. In debilitated patients, enemas, though less efficacious, may be employed. No deleterious effects have been noticed from the drug, but drowsiness is frequently a temporary result. In Wijn's experience, a single repetition of the treatment usually suffices to rid the patient of all the parasites.

The Pathology of Addison's Disease.—PORGES (*Ztschr. f. klin. Med.*, 1910, lxx, 243) has shown in a previous paper that bilateral extirpation of the suprarenal glands leads to a hypoglycemia in dogs. The adynemia, which is one of the characteristic features of Addison's disease, was found to appear coincidently with the hypoglycemia. He, therefore, determined to study the glycogen content of the liver after the same operation. Dogs were fed on a rich carbohydrate diet for some time and several hours before the operations were given, 100 grams of glucose by the stomach tube. Such a diet leads to a great deposition of glycogen in

the liver, amounting to 7.3 per cent. to 18.69 per cent. as Schondorff has shown. In one of the author's animals whose muscular strength remained good, 3.5 per cent. of glycogen was found in the liver. In the remaining nine animals, the highest glycogen content of the liver following double extirpation of the adrenals was 0.788 per cent., while in five of them the glycogen had entirely disappeared. The muscle glycogen was also absent in two animals. All of the nine animals with low or absent liver-glycogen were markedly asthenic. Porges believes, then, that the loss of adrenal secretion is responsible for the low glycogen content of the liver and the hypoglycemia, and that these two factors in turn account for the marked muscular weakness. In a footnote, the author suggests the advisability of trying a rich carbohydrate diet in patients suffering from Addison's disease.

The Blood of Newborn Infants.—Since one of the arguments against the regenerative and in favor of the degenerative nature of basophilic granules in the erythrocytes has been the frequent failure to find them in the blood of newborn infants and in human embryos, KONIG (*Folio Hæmat.*, 1910, ix, 278) has re-examined the field with the following results: Basophilic granules are found both in newborn infants (4 to 5 per cent. of cases) and in human embryos (twice in six cases). This furnishes a further argument for the regenerative nature of these bodies. Nucleated red cells were found much more constantly, being seen in 92 per cent. of newborn babes examined.

Hemolytic Substance in Schistosomum Japonicum.—YAGI (*Arch. f. exp. Path. u. Pharm.*, 1910, lxii, 156) has sought a cause for the severe anemia which is one of the striking features of infection with *Schistosomum japonicum*. This trematode is very prevalent in Japan, not only in man but also in domestic animals, such as the ox, dog, cat, etc. The author obtained the parasites from a calf. They were washed and placed in physiological salt solution. To portions of this preparation, ox, cat, and rabbit corpuscles were added. In each instance, the author noted a very weak but definite hemolysis. Since Faust and Tallquist had demonstrated that fatty acids are the active hemolytic agent of *Dibothriocephalus latus*, Yagi studied the ether extract of *Schistosomum japonicum* and found that it, too, was hemolytic for the above-mentioned corpuscles, while the ether residue was inert. Lack of material made it impossible to identify the hemolysin, but, by analogy, the author thinks it highly probable that fatty acids or similar bodies derived from *Schistosomum japonicum* are responsible for the anemia associated with infection with this parasite.

Reticulated Red Blood Cells and Basophilic Granules: Their Clinical and Morphological Significance.—FERRATA (*Folio Hæmat.*, 1910, ix, 253) in an extensive investigation, reaches the following conclusions as to the clinical and morphological significance of reticulated erythrocytes (vital staining) and basophilic granules: (1) Reticulated red cells. The *substantia reticula-filamentosa* is found normally in a few erythrocytes of the peripheral blood of adult animals; it is seen with much greater frequency (a) in the erythrocytes and normoblasts of the bone-marrow, (b) in the blood of newborn animals (30 to 40 per cent.) and in still

greater abundance in embryos. Reticulated red cells are also increased in the blood as a result of hemorrhage (traumatic anemia) and in various toxic anemias, especially primary pernicious anemia. The reticulations are plasmatic in origin, since they are formed in normoblasts with intact nuclei and also in the red cells of animals which possess only nucleated red cells. Their presence in the cell indicates its youth and they are, therefore, to be interpreted as a sign of regeneration. (The author might with profit have consulted the American literature, notably the article of Vaughan, *Jour. Med., Research*, Boston, 1903-4, x, 342, in which similar conclusions were reached several years ago). (2) Basophilic granules. Since basophilic granules are missed in the blood of all animal embryos in early embryonic life and first make their appearance when the primitive erythroblasts with relatively small nuclei begin to change into primitive erythrocytes, one must conclude that, in embryos, these granules are visible evidence of the loss of the nucleus and, therefore, a sign of regeneration. Basophilic granules are also found in adult animals in mitotic normoblasts and in the bone marrow, and, being similar morphologically to those in embryos, one must believe that here, too, they are a sign of (pathologically increased) regeneration. Ferrata believes that these granules are nuclear in origin and, with Pappenheim, assigns them to the parachromatin, while the "jelly bodies" (nuclear particles) are truly chromatic in origin.

Phlorhizin Administration and the Islands of Langerhans.—VAN LEERSUM and POLENAR (*Arch. f. Path. u. Pharm.*, 1910, lxii, 266) have investigated the assertion of Lazarus that the prolonged administration of phlorhizin is capable of causing hyperemia, hypertrophy, and hyperplasia of the islands of Langerhans. Suffice it is to say that their observations have failed to substantiate the claims of Lazarus in any particular.

A New Test for Blood in the Urine.—FLEIG (*Comp. rend. Soc. de biol.*, 1910, lxi, 192) has made use of the fact that fluoresceine is easily reduced to fluorescein in the presence of oxygenated water and a catalytic agent, as hemoglobin and its derivatives. To prepare the reagent, 0.25 gram of fluoresceine is dissolved in 100 c.c. of a 20 per cent. solution of potassium hydroxide. Ten grams of powdered zinc is added and the whole brought to a boil with constant shaking. The fluorescence disappears on boiling. The solution is filtered cold and preserved in colored bottles with a small amount of powdered zinc. Should fluorescence appear, simple shaking and filtering suffices to clear the solution. For the test in the urine, to 2 c.c. of urine in a test-tube are added 0.25 to 1 c.c. of the reagent and 3 drops of hydrogen peroxide. However little the amount of blood, a beautiful fluorescence is immediately produced. If the tube is shaken the first streaks of fluorescence pervade the whole liquid. The spontaneous fluorescence of some urines can be diluted out of existence without diminishing the reaction. The reaction should occur in 3 minutes at a maximum and persist. It is more sensitive than any other test, being positive in dilutions of blood of 1 to 1,000,000. It is practically specific for blood, very simple, easy, and sensitive.

An Experimental and Clinical Study of the Functional Activity of the Kidneys by Means of Phenolsulphonephthalein.—The pharmacological properties of phenolsulphonephthalein suggested to ROWNTREE and GERAGHTY (*Jour. Pharm. and Exper. Ther.*, 1910, i, 579) the possible advantages of its use as a functional test of the kidneys. The studies of Abel and Rowntree had shown that properly prepared solutions of the sodium salt can be injected under the skin without the slightest evidence of an irritative action. The drug can be given also by mouth without untoward effects. The administration of 0.1 gram by mouth is followed by its appearance in the urine in one to one and a half hours; the subcutaneous injection, within ten minutes. The non-toxicity of the substance was definitely established. In the application of the test the time of appearance of the drug is determined, and the amount recovered in a definite period of time. Before each test, 300 c.c. of water is given to insure free urinary secretion, and the bladder is emptied by a catheter. Noting the time, 1 c.c. of the phenolsulphonephthalein solution containing 6 mg. of the drug is injected subcutaneously, the urine is allowed to drain per catheter into a test-tube containing a drop of 25 per cent. NaOH solution in order to show clearly the first appearance of the drug by the pinkish color. After the appearance is noted, the catheter is withdrawn and the patient is instructed to void at the end of the first and second hours. The specimens are measured for their content of the drug by means of the colorimeter. In a series of cases in which the kidneys were normal as far as would be determined, the time of appearance varied from five to eleven minutes; 40 to 60 per cent. of the drug was excreted in the first hour, and 20 to 25 per cent. in the second; 60 to 80 per cent. was excreted in the two hours. The excretion of the drug was independent of the output of urine. In 3 cases of acute nephritis the time of appearance was delayed, and from 4.8 to 44 per cent. was excreted. Neither in these nor in 8 cases of chronic parenchymatous nephritis was there any evidence of increased permeability. Very marked decreased elimination in cases of long standing may be due to secondary sclerosis. The authors suggest a prognostic value of the test in such conditions. In all of ten cases of chronic interstitial nephritis the reduction in the amount eliminated was definite. The graver cases have shown a very small excretion. In cases of enlarged prostate, the authors found the test of more value than the study of the urinary output, total solids, total nitrogen, and urea estimations. A delay in appearance has suggested decreased permeability, but a marked decrease in amount has invariably meant a severe derangement of renal function. Repeated tests will eventually determine the nature, whether a chronic interstitial nephritis or a functional or secondary derangement. In addition, by ureteral catheterization, the test has been applied to the estimation of the function of one kidney as compared to the other. In normal cases, the time of appearance of the drug from the two sides has been almost always the same, from five to ten minutes. The same applies to the amount excreted. When one kidney is diseased, the time of appearance is delayed on the diseased side and the amount excreted is not only relatively but absolutely decreased. The combined output may equal that of two normal kidneys. After nephrectomy in such cases, the remaining kidney eliminates an amount greater than the combined output before operation.

SURGERY.

UNDER THE CHARGE OF

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A New Method of Performing Nephrectomy.—CASPAR (*Zentralbl. f. Chir.*, 1910, xxxvii, 793) says that few conditions have given rise to so many varieties of operation as movable kidney. Caspar has several times had the opportunity of operating the second time on a kidney which had been decapsulated in the first operation. In every such case he found that the kidney was so firmly embedded that it could be separated only with great difficulty from the surrounding tissue. On its posterior surface it was so intimately adherent to the quadratus lumborum, and on its anterior surface with the abdominal wall, that a more ideal fixation could not be desired. With the usual oblique incision in the lumbar region, the layers of the abdominal wall are divided and the kidney exposed surrounded by its fat. The peritoneum with the retroperitoneal tissue are pushed forward as far as possible and the retrorenal fascia divided as far posteriorly as possible where the kidney lies on the quadratus lumborum. It is then shelled out of its fatty capsule. The true capsule is then carefully stripped, beginning with an incision through it along the convex border of the kidney. On the anterior side the separated fibrous capsule is cut away about 1 cm. from the hilum. Only the upper half of the posterior portion is cut away, the remaining lower half being folded and fixed with two catgut sutures to the quadratus lumborum in such a position that at least half of the kidney lies under the ribs. Against and under the lower pole is packed a support of iodoform gauze. The wound is then closed by layer suture, leaving only a narrow opening for the passage outward of the strip of iodoform gauze. This is removed in five to seven days. In fourteen days the wound will be almost healed, and in three weeks the patient can be got out of bed. Caspar has done this operation in 29 cases, 19 times for movable kidney and 10 times for nephritis when it was done to overcome anuria, colic, or hemorrhage. In one of the latter a markedly contracted kidney was found and the patient died. In all the others the kidney became firmly adherent to the surrounding structures and in none did recurrence take place.

Exposure of the Base of the Skull by a Temporary Resection of the Palate.—HOFMANN (*Zentralbl. f. Chir.*, 1910, xxxvii, 817) says that up to the present time the exposure of the base of the skull through the palate has been the least developed of the operations to expose the base of the skull, and that it has been done only by a median splitting of the

soft palate and a more or less extensive resection of the hard palate. To gain a freer exposure Hofmann did the following operation: An incision is made through the mucous membrane transversely from the right premolar across the palate to the left premolar and down to the bone. At right angles to this incision another is made along the alveolar process to the palatopharyngeal arch. The direction of the incision may be reversed according to the site of the tumor to be removed. Over the hard palate the incision passes to the bone and through the whole thickness of the soft palate. The hard palate in the line of the incision is chiselled through, and by means of a periosteal elevator this osteoplastic flap is easily turned to one side. The nasal septum either breaks or can be cut through. The tumor at the base of the skull in Hofmann's case was thus exposed almost in its whole extent and was easily removed. The replacing of the flap was likewise easily accomplished. Two sutures in the transverse and two in the longitudinal portion of the incision sufficed to fix the flap in place. The hemorrhage was naturally slight owing to a preliminary ligation of the external carotid. Hofmann thinks it would still be slight in the absence of such ligation.

Therapy by Bacterins and Tuberculins in Mixed Suppurative Bone and Joint Disease.—WILLARD and THOMAS (*Annals of Surgery*, 1910, li, 761) say that inoculations by bacterins and tuberculins, either alternately or separately, depending upon the condition of the patient, furnish a valuable accessory therapeutic measure in the routine antituberculous hygienic and surgical treatment of mixed suppurative bone and joint disease. Bacterins especially tuberculins, are more potent agents for evil than for good, unless competently administered. Carefully employed, cases do no better than without bacterins, their detention in the hospital is materially shortened, and complications, if they occur, are fewer and less severe. The therapy is superfluous in mild cases where simple operation and time will effect cure; nor is it applicable to neglected cases with prolonged suppuration, characterized by bacteremia, grave sapremia, and amyloid disease. So long as the temperature fluctuates above 100°, autogenous bacterins, obtained by culturing and reculturing the suppuration found to contain variable bacteria from time to time, are administered. Tuberculin inoculations are begun when the temperature falls to 100° or preferably lower. Better results have attended the process of active immunization, where, just as in tuberculin therapy pure and simple, the treatment has been commenced with relatively small bacterial inoculations, progressively increased to the therapeutic limit, rather than by recourse to large dosage, thereby establishing immunity in the former case and in the latter avoiding anaphylaxis. Tuberculin alone in the earliest stage of acute tuberculosis has not proved of noteworthy value, probably due to the fact that the disease progresses too rapidly for the production of immunity, a result which necessarily consumes months. Studious observations of the clinical symptomatology have invariably sufficed to control the inoculations, the opsonic index as a guide proving not only impracticable but frequently erroneous.

Double Dislocation of the Astragalus.—TRENEL, WORMS, and DOECKEL (*Archiv. gén. d. chir.*, 1910, vi, 551) report a case of a complete external dislocation of the astragalus on the calcaneum and the scaphoid and an incomplete dislocation of the ankle-joint, the foot turning inward in the varus position. The patient was a chronic alcoholic. Under chloroform anesthesia the reduction was accomplished by extension, counterextension, and propulsion combined. The foot was drawn downward, and an assistant made counterextension on the leg, while pressure was made directly on the prominent portion of the astragalus, pushing it into place. Two days later the temperature rose, chills occurred, and an increasing dyspnoea set in. There was a cough, with abundant expectoration, greenish and fetid, and other signs of a bronchopneumonia developed, to which the patient succumbed four days after the accident. An autopsy showed the above dislocation and the evidence of the pneumonia. In a subastragaloid dislocation the astragalus maintains its normal relations with the tibia and fibula, while the calcaneum, scaphoid, and the remainder of the foot are displaced under it. The cause of the dislocation of the astragalus is a very severe force, generally in the young and vigorous, transmitted from above downward against the astragalus, the foot being in a varus position and forced adduction. Reduction should be attempted early, to avoid necrosis of the skin stretched over the prominent astragalus. General anesthesia is necessary to relax the rigid muscles, especially the gastrocnemius. Flexion of the leg on the thigh is very valuable. The fear of ultimate necrosis of the largely detached astragalus should not be regarded as a contra-indication to reduction. The increasing number of operative reductions of total dislocations of the astragalus prove that the nutrition does not become compromised. Pouzat, in 1884, in 31 cases of complete dislocation, showed 19 successful reductions.

Indications for the Different Methods of Operation for Hypertrophied Prostate.—BENSA (*Ann. d. mal. d. org. gén.-urin.*, 1910, i, 1903) says that no one operation can displace all the others. We ought to use several methods to suit the various forms of hypertrophy. His rule is to examine the patient from three points of view. First, he uses cystoscopy, if possible, to fix the form of the hypertrophy. He then determines its nature and consistency by the rectal touch, and takes into account the clinical signs, the hematuria, and the different secretions. Finally he goes over the general condition, and examines the lungs, heart, and kidneys. According to the form of the hypertrophy, its nature, and the general condition of the patient, the choice of operation is determined. Total transvesical prostatectomy is applicable to fibro-adenomatous forms involving the lateral lobes, in patients still young and little infected. It should be done in two stages in those infected temporarily. Notwithstanding our progress in technique, patients still die of hemorrhage and at times of infection, which is more easily avoided. Whatever the method of operation and the habits of the operator, the mortality remains about 10 to 15 per cent. Partial transvesical prostatectomy is indicated for pedunculated median lobes. Perineal prostatectomy is preferable for the suppurating forms, because of the facility of drainage, and sometimes for the low forms of hypertrophy. The Bottini operation is appropriate for soft hypertrophy of the lateral lobes (which can be

enucleated with difficulty if at all), hypertrophies of the median lobe in the form of a bar, and for stenoses of the vesical neck. It is also indicated when the patient refuses the operation by the abdomen and, finally, when, because of his serious condition, he does not seem able to sustain any other serious operation. This operation is very rational in that it removes only that which obstructs the posterior urethra and neck of the bladder, and, almost without danger, relieves the retention of urine. Suprapubic cystotomy should sometimes be associated with the deep cauterization of the obstruction at the neck of the bladder or of the prominent lobes, in the bleeding cases, or in the infected. Sometimes it may be employed alone to keep the bladder healthy and clean, by interposing a means of discharge between the lower and the upper urinary paths. It constitutes then the last resource in those patients in whom all the ramifications of the urinary apparatus are distended and infected.

Post-traumatic Osteitis of the Carpal Scaphoid Tending to a Spontaneous Fracture.—PREISER (*Zntrbl. f. Chir.*, 1910, xxxvii, 929) calls attention to what he considers to be a not very rare post-traumatic osteitis of the carpal scaphoid bone, of which he has seen 6 cases. As a rule, the condition pursues the following course: After a fall upon the hand there develops, with swelling and pain, usually a slight limitation of motion, and tenderness over the scaphoid, especially in the tabatière anatomique. The Röntgen rays showed in five cases a more or less round or elongated clear space, which often involved the whole of the scaphoid. A primary fracture does not seem to precede it. Gradually the defect increases, the walls break through, and the scaphoid finally gives about the same picture as a recent fracture. The clinical course is very chronic, the disturbances remaining only in mild degree. The condition probably originates in a primary tearing of the dorsal ligament between the scaphoid and semilunar bones, which leads to a disturbance of the nutrition of the central portion of the scaphoid, with resulting rarefying osteitis, which shows in the skiagram as a visible defect and finally causes a spontaneous fracture. The scaphoid is almost entirely surrounded by joint surfaces and is chiefly nourished, as Lexer's injection experiments show, by the bloodvessels in the scaphoid-semilunar ligament. The rarefaction appears very soon. In one case in two days after the accident there were visible in the skiagram three round defects, which, in spite of fixation, in ten days had united with the formation of a transverse clear space in the bone. Then followed, however, as the later skiagrams and the complete clinical restoration demonstrated, a healing in of the defect. Probably by this time the other small vessels to the bone have reestablished the nourishment of which it was deprived.

The Treatment of Gangrenous Hernia without Immediate Removal of the Incarceration (Entero-anastomosis above the Hernial Canal).—HESSE (*Zntrbl. f. Chir.*, 1910, xxxvii, 1033) says that it is gradually becoming recognized that the most desirable result is obtained from a primary resection of the incarcerated portion of the intestine and the immediate renewal of the intestinal current, by suture of the divided ends of the bowel. This exposes the patient to the danger, however, of a septic

peritonitis and to the risk of an extensive and prolonged operation in his weakened condition. When, however, the hernial contents are foul or suppurative, in consequence of the disturbances in the intestinal wall, or there is a perihernial phlegmon, the danger of peritonitis may be excluded by performing first an entero-anastomosis, and leaving the separation and removal of the gangrenous and resected bowel to the end of the operation. If a perihernial phlegmon is diagnosticated, it should not be attacked first; or if the incision over a strangulated hernia exposes a threatening or actual perforation of the gangrenous loop of intestine, this part of the operation should be stopped at once. Then with slight elevation of the pelvis an incision should be made parallel with and 3 cm. above Poupart's ligament, and should extend into the abdomen. The afferent and efferent limbs of the incarcerated intestine will readily be recognized. If they are in good condition, a lateral anastomosis 5 to 6 cm. wide is made between the two limbs, far enough away from the incarceration to permit careful handling of the intestine without pulling on the incarceration, which should be covered with gauze, and to permit at a later period a resection of the excess of bowel and a closure of the open portion. The corresponding mesenteric surfaces are approximated by a few sutures to prevent the formation of an opening which may lead to a later ileus. The laparotomy wound is closed completely or partially. In the latter case a strip of gauze is introduced to act as a protection from the inner opening of the hernial ring. Now for the first time the phlegmonous area is opened extensively and the foul contents of the hernial sac and gangrenous intestine are evacuated. The strangulation is not relieved nor is the incarcerated intestine in any way pulled upon. A suitable dressing isolates the two wounds from each other.

Hemorrhagic Glossitis in Hemophilia.—UMBREIT (*Deut. Ztschr. f. Chir.*, 1910, cv, 608) reports the case of a man, aged thirty years, who had no family history of hemophilia, but whose life had been threatened several times from hemorrhage due to the extraction of teeth and similar trivial wounds. On December 5, 1909, a red spot appeared on the tip of his tongue, which rapidly became a painful swollen mass, giving rise to a marked dysphagia and dyspnoea. He sought admission to the hospital for relief on the same day, when the tongue protruded 2.5 cm. in front of the separated teeth, was of a deep bluish-black color, stony hard, and immovable, and was 3.5 cm. thick. The floor of the mouth and the region between the chin and the hyoid bone were infiltrated with blood. The posterior part of the tongue showed no changes. Breathing was difficult and swallowing impossible. The temperature was 37.5° C. and the pulse 120, moderately strong, and regular. The internal organs were normal and the urine free of sugar and albumin. After puncture, painting with adrenalin, and other such measures, without success, on the following day, notwithstanding the danger of a possible severe hemorrhage, an incision was made in the floor of the mouth. A forceps was introduced into a mass of coagulated blood about the size of a walnut. No hemorrhage occurred, and the wound was tamponed. On the following day the removal of the tampon was followed by the trickling escape of a thin fluid blood stream, which continued for five days, in spite of all measures to stop it, until a very

marked anemia developed. The day before this the temperature rose to 39.2° C. and the pulse to 164, which became very weak and irregular. An extensive hematoma developed under the chin, the skin here became dark blue, the lymph nodes much swollen, and the patient complained of much headache. On the tenth day the swelling subsided slightly, the skin became red, and necrotic tissue escaped from the wound under the tongue. The secretion again became bloody, and the bleeding did not cease for three days. Gradual improvement set in and continued until, on January 13, the patient was discharged cured.

A New Method of Closing the Intestine.—KLAPP (*Deut. Ztschr. f. Chir.* 1910, cv, 559) closes the divided end of the intestine by first rolling it over on itself with a suitable forceps. The portion to be divided is first crushed by a proper pressure forceps and then seized with a long, narrow, and tightly closing intestinal clamp. It is now divided close to the forceps, preferably with a thermocautery, and then rolled on the forceps until there is a good serous contact between the rolled portion and the neighboring intestine, when a sufficient number of Lembert sutures are placed to fix it in this position. Finally, the branches of the forceps are opened, separated from each other, withdrawn individually, and the small opening through which they were removed is closed by a few sutures. When carried out on the lower animals, as in performing the Billroth II operation for resection of a portion of the stomach, and the duodenal end had been turned analward and closed, strong distention of the duodenum with air or water permitted no leakage at the site of the closure. When the distention was increased more and more it was found that not the closed end, but other parts of the bowel gave way. In actual practice, he employed the method twice in the Billroth II operation, three times in a resection of the large intestine, and frequently with the appendix.

Treatment of Wounds of the Heart.—KIRCHNER (*Annals of Surgery* 1910, lii, 96) says that the heart may be manipulated without serious injury to the organ, and is amenable to surgical interference and procedure. Hemopericardium with heart tamponade is a serious complication, and demands prompt drainage of the pericardial sac. In suspected injuries to the heart the wound in the chest should be carefully explored so that the extent of the injury may be determined, and in cases of doubt exploratory pericardiotomy is indicated. Small wounds of the heart may heal spontaneously, but in all cases where hemorrhage from the heart exists, the wound should be promptly sutured. In operations upon the heart, when pulsations suddenly cease massage of the heart and artificial respiration should be tried as aids in resuscitation. With a minimum amount of anesthetic the healthy lung is capable of performing its function, though to a less extent, even when the pleural cavity is exposed. Time is an important factor in injuries to the heart, and an early diagnosis should always be made. The immediate treatment should be directed to the control of hemorrhage and shock. The chief remote complications result from infections of the pericardium and pleura. In treating injuries to the heart, the surgeon should have in mind a definite plan of attack, and the kind of a flap to be used in approaching the heart should be determined by the nature of the wound in the chest.

THERAPEUTICS.

UNDER THE CHARGE OF

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The Use of Sour Milk in the Treatment of Constipation.—LUKE (*Practitioner*, 1910, lxxiv, 653) has had good results with the use of sour milk in constipation. His method of administering it is as follows: Patients usually take their first glassful at breakfast in the place of porridge. It is convenient to turn the milk out into a cold pudding plate and sprinkle the curd with sugar, or with a mixture of cinnamon and sugar. Some patients enjoy the slightly acid, sharp taste, and find it more agreeable and appetizing without any added sugar. A brown meal biscuit goes well with it. At lunch the patient takes the curd instead of soup, and at dinner to replace any sweet pudding or pastry. This makes a convenient distribution and prevents the patient feeling that the extra bulk of food is embarrassing. Some patients who are on a purin-free diet and do not take afternoon tea find a glass of curd acceptable at 4 P.M., especially in hot summer weather. Luke has never found patients to suffer any material inconvenience or digestive discomfort which was traceable to this diet. If any flatulence or discomfort is experienced for a day or two, the amount of milk taken should be reduced and gradually increased once more as the patient gets accustomed to it. The time for which the milk is taken should never be less than six weeks, if it agrees at all, and it may be quite well continued for six months, and afterward taken occasionally as an article of daily diet.

The Soy Bean as an Article of Diet for Infants.—RÜHRÄH (*Jour. Amer. Med. Assoc.*, 1910, liv, 1664) advocates the use of the soy bean as an article of diet for infant feeding and diabetics, on account of its large percentage of protein. The soy bean, sometimes incorrectly called the soja bean, is a staple food among the Chinese and Japanese, and probably accounts in part for the small amount of other nitrogenous food taken by them. Rühräh thinks that this general and continued use of the bean demonstrates conclusively that the protein of the bean may be utilized in the body in place of that of other vegetables and of meats. The soy bean may be cooked in the form of soups, gruels, and porridges, or may be eaten raw as a vegetable or salad. He does not think, however, that the soy bean will ever replace meat in ordinary diet, but that it will be found of value as a source of protein when meat is contraindicated and especially when, as in diabetics, the patient tires of meat. He also believes that it is of great value in difficult feeding cases in infants. As soy beans are not available in most markets, and as their cooking is a tedious process, Rühräh had a flour manufactured from the bean. The analysis of this flour showed a protein content of 44.64 per cent. The percentage of protein was almost one-third greater than the

percentage in the whole beans, due to the removal of the coarse fibrous hulls. Each ounce of this soy gruel flour yields about 13 grams of protein and 120 calories, and it can be used (1) as a gruel, (2) in broths, (3) in making biscuits or muffins. It may also be mixed with cereals, barley jelly, cream of wheat, and similar foods. Rührhah gives the method of preparation of gruels, broths, and muffins from this soy-bean flour in his article. He also discusses the indications for its use in difficult infant feeding cases, and believes that the soy-bean flour solves the difficulty of supplying sufficient protein in a form in which it can be digested and assimilated by infants and young children.

The Physical Treatment of Bronchial Asthma.—HOFBAUER (*Med. Klinik*, 1910, vi, 894) is of the opinion that incandescant light baths are of great value in the treatment of bronchial asthma. The electric light baths induce an active hyperemia of the skin, thus reducing the congestion of the bronchial mucous membrane with a consequent increase in the size of the lumen of the bronchus. Hofbauer thinks that their good effects are largely due to the prolongation of the expiration induced by the heat. This effect is supplemented by breathing exercises, to lengthen the period of expiration, which the patient accentuates by sounding a musical note. Hofbauer has cured a number of patients by these breathing exercises, the cure remaining complete for over two years.

Vasotonin: A New Remedy for Lowering Blood Pressure.—MÜLLER and FELLNER (*Ther. Monatshefte*, 1910, xxiv, 285) report both animal experiments and clinical observations concerning the effect of vasotonin upon blood pressure. Vasotonin is a combination of yohimbin and urethane. Müller conducted the animal experiments, and found that vasotonin lowered the blood pressure by dilating the peripheral blood-vessels. He could determine no depressant action upon the heart muscle. There was no depression of the vasomotor centre, and no effect upon the respiration occasioned by its use. Fellner relates his clinical results obtained in 30 cases of increased arterial tension. He gave vasotonin subcutaneously in doses of 1 c.c. The injections were given in some cases daily, in other cases every other day. The course of treatment comprised from 20 to 30 injections. He found that the remedy consistently produced a fall of blood pressure with a marked improvement in the subjective symptoms. Thus, for instance, there was immediate relief in the milder cases of angina pectoris, and in cardiac and bronchial asthma. The severer cases of angina pectoris required a longer period of treatment, but also showed distinct improvement. No unpleasant symptoms occurred as a result of the injections except some feeling of fullness in the head, but not equal to that caused by the nitrites or nitroglycerin.

The Treatment of Delirium Tremens with Veronal.—VON D. PORTEN (*Therapie d. Gegenwart*, 1910, li, 270) compares the results obtained by the treatment of delirium tremens with veronal with those obtained by the use of chloral hydrate and bromides. There were 396 cases treated with chloral and bromides. The treatment in these cases consisted in the administration of from 15 to 45 grains of chloral hydrate,

given usually only on the first day, but occasionally repeated on the second day. The chloral was often combined with 15 grains of bromide given every two hours. Of these cases, 77, or 18.1 per cent., developed a frank delirium and 36 died, thus giving a mortality of 9 per cent. The number of cases treated with veronal was 264. These patients received 15 grains of veronal in warm tea, which dose was repeated in one or two hours. The amount was usually enough to make the patient quiet and insure a deep, quiet sleep. If this result was not obtained, a third dose of 15 grains was given after five hours. The author notes also that in the severest cases it was necessary to give as much as 60 grains during the first twelve hours before the desired result was obtained. He has never seen the slightest untoward effects upon the part of the pulse or respiration from this dosage. Of the cases so treated, only 15, or 5.6 per cent., developed a frank delirium, while the mortality fell to 3.4 per cent., as compared with 9 per cent. in those treated with chloral and bromides. The author also notes that the period of delirium averaged much less in the cases treated with veronal.

Bronchial Asthma in Relation to the Exudative Diathesis.—VON STRÜMPPELL (*Med. Klinik*, 1910, vi, 889) states that bronchial asthma should be included in the group of affections distinguished by an irritability of the nervous system and a tendency to exudative processes in various parts of the body. He mentions as members of this group, urticaria, eczema, angioneurotic oedema, intermittent swelling of the joints, and nasal and intestinal catarrh. He considers that membranous colitis, with the secretory disturbance of the mucosa accompanied by a spasmodic contraction of the muscular coats of the intestine, is closely related to bronchial asthma. Membranous colitis may therefore be entitled "intestinal asthma." Von Strümpell thinks that the nervous factors explain the benefit derived from atropine, adrenalin, and other remedies advised in asthma. He has had the best results in treating bronchial asthma by the use of the alkaline iodides, and the systematic application of incandescant electric light baths. He believes that both serve to correct the overproduction of mucous and so lighten the severity of the attacks. These must be supplemented by dietetic restrictions to prevent overfeeding.

Gout.—FOSTER (*Yale Med. Jour.*, 1910, xvi, 477) draws a sharp demarcation between the various symptoms which are commonly attributed to "goutiness" and the clinical entity of gout. The symptoms which are assigned to goutiness are due to other causes, as these cases usually present none of the characteristic stigmas of gout. In the treatment of acute attacks of gout Foster considers that the prime object to be secured is the comfort of the patient. To this end he advises the use of wet dressings or protection of the inflamed joints from pressure. If the pain is severe, opium must be employed. Colchicum is the only drug that he considers of any value at this stage of the disease, but caution should be exercised that the digestion is not deranged by its prolonged use. During the febrile interval the food should be limited to milk and gruels. Convalescence may be hastened by hot baths with gentle manipulation of the affected joints while in the bath, and light massage afterward. Foster thinks that the result secured in

treating individuals who have had one or more attacks of gout must be mostly through the diet and mode of life. He gives the following as fundamental principles: Build up the cachectic and undernourish the obese; compel the patient to take all the exercise his strength permits; avoid sudden changes in diet or habits; give as much attention to the digestive function of the patient as to the purin content of his diet. All of the dietaries that have been advised for gout in the last two hundred years present two features; an endeavor to restrict the total amount of food taken and to lessen the chance of gastro-intestinal disorders. Foster believes that there is no excuse for overfeeding with our more accurate methods now of determining the actual food demands. The amount of meat that should be allowed each patient must be determined by obtaining the excretory capacity of the patient. This can be done only by accurate urine analysis. Whether the elimination be prompt or restricted, a period of four or five "purin-free" days in each month is often advisable. Foster thinks that little benefit is derived from the use of drugs. No drug is known to have any influence on uric acid metabolism, much less the power of dissolving the deposits of sodium urates in the joints. The claims made for some drugs, such, for example, as piperazin and quinic acid, rest on test-tube experiments that are not borne out when applied to living tissues. The use of alkalies, first advocated by Boerhaave, has not now the repute it formerly held. Von Noorden asserts that alkalies cause a retention of uric acid and precipitate attacks. The salts of lithium are entirely useless. The only drugs which Foster considers to possess any value are the salicylates, which are occasionally given to relieve pain, and the iodides. Hydrotherapy is of great help in many cases. The "cures" at resorts are of undoubted benefit, but when the patient cannot leave home much can be accomplished by means of hot air and steam baths with massage.

Further Observations upon the Practical Application of Sodium Chloride in the Treatment of Epilepsy.—ULRICH (*Münch. med. Woch.*, 1910, lvii, 1173) advocates sodium chloride for the treatment of the symptom complex known as bromism occurring as a result of long-continued use of the bromides. He says that sodium chloride seems to have a physiological action directly antagonistic to that of the bromides. He believes that sodium chloride is able to cure promptly and certainly the motor, sensory, and psychic symptoms of acute bromism. All skin affections disappear promptly with the administration of sodium chloride. Ulrich has also noted that sodium chloride is able to incite epileptic attacks in old epileptics who have been so saturated with bromides that they have reached a state bordering on insanity. He believes that after these induced convulsions these patients are in a much better mental condition than before. Ulrich is firmly convinced that sodium chloride is far superior to all of the present remedies for bromism.

PEDIATRICS.

UNDER THE CHARGE OF

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Epigastric Pain as a Complication of Mumps.—Supplementing Dr. Godfrey's article on epigastric pain as a complication of mumps being due to pancreatic metastasis, CECIL REYNOLDS (*Brit. Med. Jour.*, 1910, ii, 352) suggests that this condition is due to the organisms of mumps or secondary organisms growing on a dry tongue and being capable of producing acid from sugars, setting up a fermentation of carbohydrates when swallowed, and thus causing a pylorospasm. He has seen this condition in mouth breathers from whatever cause. Edward Penny reports seeing many cases of epigastric pain with vomiting in the last stages of mumps. Out of 20 cases in one school, 10 followed this course, and all showed tenderness to pressure over the pancreas. Fox reports a similar case: on the fifth day of mumps a boy developed fever, epigastric pain, and vomiting, and a deep-seated swelling was felt in the epigastric region. There was no sugar in the urine, and the boy recovered.

Hereditary Lues and the Wassermann Reaction.—PAUL MULZER and WALTER MICHAELIS (*Berl. klin. Woch.*, 1910, xlvii, 1402) have tested the clinical worth of the Wassermann reaction, and especially a modification of this reaction in which a smaller amount of serum is used for work on children with hereditary syphilis. They use about 0.05 c.c. of the serum taken from about ten drops of blood; and they used it only in syphilitic children or in suspected cases. Out of 44 children, manifestly luetic, with lesions on the skin and mucous membrane, they found a positive reaction 42 times and a negative reaction twice. In early congenital lues they found a positive reaction in 95.6 per cent. One child of two months gave a negative reaction three weeks before the syphilitic outbreak (the parents being syphilitic). With the first development of the disease the child gave a positive Wassermann reaction. Another child with two syphilitic sisters gave negative reactions until after the development of a coryza. A seven months' premature infant, whose father had syphilis, gave a positive reaction, but showed no physical signs of the disease. A premature infant whose mother had syphilis and gave the positive Wassermann reaction showed no physical signs and a negative reaction. In 44 children with latent syphilis, with no acute symptoms or none since a previous treatment, 26 showed positive and 18 negative reactions. More than half of the latent hereditary syphilitic children show positive reactions. Out of 73 children suspected of syphilis and suffering from anemias, enlargements of the glandular system, spleen, or liver, poliomyelitis, and periostitis, 18 positive reactions were found. In 19 such cases only 5 showed a negative reaction after treatment with protiodide of mercury (gr. $\frac{1}{6}$ to $\frac{1}{3}$) and inunctions. Out of 22 mothers of syphilitic children, 21 knew of no syphilitic infection, but 17 of them gave positive reactions; 15 had children

under one year old and two had older syphilitic children. Out of 12 apparently healthy sisters of syphilitic children, 5 gave positive reactions. In infants and children with clinical signs of hereditary syphilis, from 90 to 100 per cent. will show positive Wassermann reactions. Children with manifest lues react like a syphilitic in the secondary stage, 96 per cent. positive. Positive reactions appear first with the onset of the manifest syphilitic symptoms. Latent syphilitic children react as adults do in the early latent period. It is more difficult to change a positive to a negative reaction by anti-syphilitic treatment in children than in adults. Mothers of syphilitic children show, in the greater majority of cases, a positive reaction (83 per cent.). The later children born of syphilitic parents, but having no symptoms of syphilis, show negative reaction.

Chlorosis.—PAUL GROAG (*Münch. med. Woch.*, 1910, lvii, 1596) supplements the investigations of Morawitz on chlorosis. In his own cases it was not so much the subjective symptoms found in light chlorosis and neurasthenia, such as exhaustion in the morning, lack of desire for exertion, slight headache, as the striking pallor of the face and mucous membranes, which led him to suspect chlorosis. In most of the cases he found a systolic murmur in the heart and accentuated pulmonic second sound. The blood examination always showed the normal number of red blood corpuscles, and hemoglobin from 90 to 95 per cent. In all the cases treatment with iron was followed by the best results, relieving not only the subjective symptoms, but causing a disappearance of the pallor. He agrees with Morawitz in calling these cases chlorosis, with a normal hemoglobin percentage, but an increase in the entire blood quantity. In regard to the etiology, he adds that almost all of his patients gave a history of masturbation or interrupted coitus. Since almost all authorities mention the genital functions in relation to chlorosis, he believes that this association is important, especially so since most of the before-mentioned symptoms of chlorosis are found in cases of masturbation in young men. It is possible that a blood condition analogous to chlorosis, only milder, occurs at puberty in the male sex, in which the number of blood cells and the hemoglobin is normal, but the entire blood quantity is increased.

Vincent's Angina.—J. D. ROLLESTON (*Brit. Jour. Child. Dis.*, 1910, vii, 299) presents a study of 32 cases of Vincent's angina. This condition presents a faucial lesion usually unilateral, deep ulceration of the tonsil and adjacent structures, a peculiar fetor, and enlargement of the corresponding lymph glands. It is associated with a fusiform bacillus and a spirillum described by Vincent in 1896. This form of angina is uncommon. Out of 3047 cases of angina, only 95 were diagnosticated as Vincent's form. It averages from 0.5 per cent. to 0.9 per cent. in all cases of sore throat. It is relatively rare in adults, except those working in dissecting rooms or among cadavers. It is most frequent up to the tenth year. It is feebly contagious and is usually transmitted by vessels used in common. It is commonest in spring and rarest in autumn. While Vincent emphasizes previous ill health and oral sepsis as predisposing factors, these were not prominent in this series of cases. An ulcerative and membranous form of

the disease are distinguished, but Rolleston claims the ulcerative is a later stage of the membranous. It often stimulates diphtheria, but the adenitis is not as severe and suppurative adenitis is unknown. The fetor is characteristic and different from that of diphtheria. There is a marked disproportion between the severity of the local and constitutional symptoms, the latter being light and short. The throat heals rather slowly, however, the average time in this series being eighteen days. The co-existence with diphtheria is not common, but does occur, and antitoxin in these cases seems beneficial. When associated with syphilis, mercurial treatment materially assists resolution. The disease is usually primary, prognosis favorable, and complications are infrequent. The treatment consists of local swabbing with undiluted tincture of iodine. A solution of chlorate of potash and myrrh is used for the fetor and a preparation of powdered methylene blue is useful for the ulceration.

Brudzinski's "Neck Sign" and the Contralateral Reflex in Meningitis.—JOHN LOVETT MORSE (*Archives Pediat.*, 1910, xxvii, 561) has investigated Brudzinski's claim that the "neck sign" and contralateral reflex is not found in healthy children, or in any cases of disease except tuberculous or epidemic meningitis. The contralateral reflex is a concomitant reflex of the leg on one side when passive flexion of the leg on the other side is made. The motion of the other leg is extension instead of flexion at times. The "neck sign" consists in passive flexion of the head forward, the other hand being pressed on the chest. In meningitis this will cause flexion of the legs at the hips and knees and a marked flexion of the legs on the pelvis. Greco and Zaimvosky have investigated the contralateral reflex in a large number of cases, and entirely agree with Brudzinski's claim for its value. The "neck sign" was tested in 42 cases of meningitis, where it was positive in 97 per cent., the contralateral reflex being positive in 66 per cent., Kernig's sign in 57 per cent. and the Babinski in 50 per cent. of the cases. Morse examined 400 children, 90 of whom were well and the others suffering from diseases not of the nervous system or meningitis. Neither the "neck sign" nor the contralateral reflex was elicited in any instance. This corroborates Brudzinski's claim. Morse also examined 11 cases of tuberculous, 5 of cerebrospinal, and one of pneumococcic meningitis for the presence of these two signs. The ages varied from six months to eleven years. In the cases of tuberculous meningitis the results were not constant. The contralateral reflex was usually absent; when present it was identical. The "neck sign" was found more often, but was never constant. In the cases of cerebrospinal meningitis the contralateral reflex was never found, but the "neck sign" was positive much more often than in the tuberculous variety, and when present flexion always occurred in both legs. In the case of pneumococcic meningitis the contralateral reflex and the "neck sign" both were present on one side, the other side being paralyzed. Morse concludes that the two signs are never present in healthy infants and children or in those ill with diseases other than those of the nervous system, and that they are almost never present in diseases of the nervous system outside of meningitis. Of the two, the "neck sign" is found more constantly. Their presence in acute disease is strong evidence of meningitis, but their absence does not exclude meningitis.

OBSTETRICS.

UNDER THE CHARGE OF

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Gallstones during Pregnancy and the Puerperal Period.—PETERSON (*Surg., Gyn., and Obstet.*, July, 1910) reviews the literature on this subject and reports a case operated upon by Nancrede at six months' pregnancy. Death followed in this case, from postoperative hemorrhage and exhaustion. He finds that gallstones are most commonly met with during pregnancy, in patients between the ages of twenty and thirty-five. Pregnancy undoubtedly conduces to the formation of gallstones. Pregnant patients suffer an attack of pain and distress usually about the fifth month, when the uterus is approaching the level of the umbilicus and beginning to crowd the intestines against the liver. In puerperal cases symptoms usually manifest themselves during the first seven days of the puerperal period. Such patients suffer from chills and fever with jaundice. Sixty per cent. of pregnant patients suffer more or less from jaundice. In the puerperal period the frequency is 10 per cent. Among pregnant patients operated upon the mortality was 13.04 per cent.; in the puerperal period the mortality was 11.01 per cent. In pregnant patients more than one-half of the gallstones were found in the bladder, and this was true of the puerperal cases. There is no reason to believe that operations upon the gallbladder are more apt to interrupt pregnancy than are other abdominal operations. If the patient is in good condition, operation should be deferred until the child is viable, lest premature birth be induced. The diagnosis of the condition in pregnancy and the puerperal state is not especially difficult, and jaundice will be found a valuable symptom.

Vaccine Therapy.—At the recent meeting of the American Gynecological Society (*Surgery, Gynecology, and Obstetrics*, July, 1910) the committee appointed to investigate the employment of vaccine therapy in gynecology and obstetrics, composed of Dr. J. Whittridge Williams, Dr. Edward B. Cragin, and Dr. Franklin S. Newell, reported essentially as follows: The evidence at present available justifies tentative conclusions only. To produce active immunity opsonins undoubtedly have influence. Unfortunately the practical value of the opsonic index is questionable because it is technically difficult and is subject to great variations. Against typhoid, cholera, plague, and dysentery immunization by vaccines is a well-established prophylactic measure. In local infections by the staphylococcus or tubercle bacillus, vaccine therapy is valuable, and less so in local infections with other germs. In acute general infections the value of this method of treatment has yet to be proved. Vaccine therapy is a valuable adjunct and occasionally curative in chronic gonorrhoeal arthritis and urethritis. It is also valuable in the vulvovaginitis of children, but does not always succeed. The bacteriuria of infections of the urinary tract by the colon bacillus is

not relieved by vaccine therapy. The symptoms seem sometimes considerably lessened. The scanty reports concerning pyelitis and pyelonephritis in pregnancy do not indicate that this method of treatment is more successful than the usual methods employed. In some cases of endometritis after curetting vaccine therapy seems to be of benefit. There is not sufficient evidence concerning its use in pelvic inflammatory disease to warrant conclusions, but in chronic cases after operation it might prove useful. As the ordinary localized puerperal infections, irrespective of the nature of the infecting germ, tend to spontaneous cure, the use of vaccine therapy must be limited to acute general infections. Here the method appears to be of little value at present, but the most that can be said of it is that it does not produce harm.

Bilateral Tubal Pregnancy with Coincident Development.—FINDLEY (*Surgery, Gynecology, and Obstetrics*, July, 1910) has collected from the literature 28 cases of bilateral tubal pregnancy, in many of which the proofs as to the nature of the condition are not conclusive. But 8 are unquestioned. He adds the case of a nullipara who had disturbed menstruation, hemorrhage, and pelvic pain. The abdomen became distended and a boggy mass filled the pelvis. The uterus was but little enlarged and crowded forward. At operation the peritoneum was inflamed and several pints of fetid blood clots were in the lower abdominal cavity. Both tubes were removed, and on the left side was a tubal abortion, and on the right a blood mole at the ampulla of the tube. Death followed eight hours after the operation from exhaustion and shock. It was thought that the escape of the ovum and blood through the abdominal end of the left tube and of its twin ovum through a rent in the ampulla of the right tube were probably simultaneous. Placental tissue, decidua, and chorionic villi were found in both tubes. No foetus was found. The ovaries were cystic and bound by adhesions.

When Shall Operation Be Done for Puerperal Septic Infection.—POLAK (*Surgery, Gynecology, and Obstetrics*, July, 1910) reports the results of 200 cases of septic infection as follows: In 72 extensive exudates, supuration was a late result. The earliest abscess occurred on the nineteenth day, the latest on the eighty-second day. In 3 opening was made by an extraperitoneal incision above Poupart's ligament. Four were opened by vaginal section. In 65 cases the exudate was completely absorbed under the influence of time, rest, and baking with dry heat. Polak believes that a local focus, postpartum, should not be disturbed so long as the patient improves, unless there develops definite evidence of a localized collection of pus. In none of these cases was the application of heat employed until the acute process was in abeyance. There were 5 cases of ruptured uterus, 3 of which had been packed in dirty tenements for the control of hemorrhage, and were therefore considered septic and radical operation performed. Of the 5 cases, 3 made complete recoveries after complications, 2 died, although operation was performed. One case of septic purulent peritonitis following criminal abortion, died, although the peritoneal cavity was drained. The fourth fatal case was admitted in a dying condition and expired a few hours after a Pryor operation. One case died of acute gastric dilatation 52 days after confinement, and eight days after

an abdominal exploration and vaginal drainage for a collection of pus in the right broad ligament. A sixth case died from septic endocarditis and general infection forty-seven days after confinement. Streptococci were repeatedly demonstrated in the blood, and vaccine and supportive treatment failed to benefit the patient. This case had been curetted twice by local physicians. In the 200 cases there were 6 fatalities. The Pryor operation, or isolating the uterus and pelvic peritoneal cavity from the general peritoneal cavity, by the use of gauze packing, was performed twelve times. Polak believes it to be valuable in early pregnancy, where the sigmoid assists in shutting off the pelvic cavity. There were 46 cases of putrid endometritis, all of which recovered with disinfection of the uterine cavity with gauze soaked in iodine. Seventy-two cases had exudates, 63 of whom had been curetted before admission. Suppuration occurred seven times in these cases. There was no mortality. Pelvic cellulitis was present in 16 patients, in whom there had been extensive cervical lacerations. In one case suppuration occurred with fatal results. There were 17 cases of streptococcic septicemia, and 10 cases of bacteremia, with one death from septic endocarditis. There were 2 cases of pyemia with multiple foci, both of whom recovered; 126 suffered with pelvic peritonitis, all of whom recovered with vaginal drainage. Five cases of uterine and femoral thrombophlebitis recovered with protracted convalescence. In 3 cases of septic purulent peritonitis, 1 died and 2 recovered. In these the treatment consisted in ordinary abdominal incision, tube drainage with aspiration of the tubes every three hours, the high Fowler position, the instillation of salt solution, and gastric lavage. Starvation was practised until the patient began to improve. There was one case of intramural abscess in the uterus, which recovered with drainage. The general conclusion of this series of cases is, that operation must be determined by the merits of each individual case only; that so long as the patient is improving, interference should not be practised; that care must always be taken not to break down the protective barriers which Nature establishes in these cases.

Early Rising in the Puerperal Period.—VELITS (*Zent. f. Gyn.*, No. 25 1910) gives the results of his investigations in 496 puerperal cases, many of them being in the hospital during pregnancy; 68 per cent. were allowed to get up early after confinement; of those coming into the hospital at the time of confinement, 59 per cent. The latest period was seven days after labor and the earliest five. Afterward patients were allowed to get up earlier, and two left their beds the first day after confinement. At first this was limited to patients who had had normal labors, but afterward those who had had operations, even of some severity, were also included. In 174 operative cases 70 got up within a short time after the operation. In 84 patients having sutures inserted for lacerations of the vagina and perineum 33 who got up early had healing by first intention, their wounds finally closing without complications. In these cases aluminum bronze wire was used for suture. It was observed that involution went on rapidly in these cases, that a bloody lochial discharge ceased early, and that bronchial secretions in general did not endure as long as when patients remained in bed. The use of the catheter was avoided and the bowels acted more regularly and earlier. Thrombosis and embolism were not observed.

GYNECOLOGY.

UNDER THE CHARGE OF

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Experimental Researches upon the Nervous Reflexes from Different Organs and Peripheral Nerves upon the Uterus.—The reflex relations existing between the uterus and other organs of the body, especially the breasts, gastro-intestinal canal, nose and bladder, have been commonly recognized by clinicians, based purely upon clinical observation or the acceptance of empirical facts as handed down from generation to generation. Therefore but little effort has been made to prove by actual experimentation the truth or fallacy of these observations, or to determine the pathways by which such reflexes are carried. In a most interesting and instructive article, E. KEHRER (*Archiv für Gynäk.*, 1910, xc, 169) reports in full the results of his painstaking and difficult experiments concerning this important subject. Following a concise description of the general technique employed, he details his methods of procedure upon the different organs and summarizes freely his conclusions, only a few of which will be mentioned here. The most intense reflex influences upon the uterine movements were produced by irritation of the gastro-intestinal canal, especially of the colon. Stimulation of peristalsis by mechanical or chemical stimuli was accompanied by increased uterine contraction. Inhibition of peristalsis as produced by artificial distention of the stomach and segments of intestine produced likewise an inhibition of the uterine movements, a stage of rest with muscular relaxation. Division of the vagus or pelvic nerves produces a slight transitory inhibition of the uterine contractions; division of the sympathetics is accompanied by intense excitation. The afferent pathway for both inhibitory and stimulating impulses from the stomach and ileum is through the splanchnics; from the colon through the hypogastrics. The efferent section of the reflex arc is through both splanchnics and hypogastrics. The reflex centre for the entero-uterine connection lies in the prevertebral ganglia. Dilatation of the bladder and ureters leads to reflex inhibition, contraction of the bladder to reflex stimulation of the uterine musculature. Even after complete division of the hypogastric and pelvic nerves the vesico-uterine reflex persists, showing the presence of an independent reflex mechanism. Kehrер was unable to determine definitely the paths of the reflex between the breasts and uterus.

Genital Prolapse: Its Operative Correction Based on a New Study of Cleavage Lines and Sliding Segments.—R. L. DICKINSON (*Amer. Jour. Obst.*, 1910, lxii, 17) summarizes his article as follows: From the point of view either of pathological anatomy or surgery frozen sections show the importance of recognizing certain cleavage planes in the pelvic diaphragm, and intervening segments that slide. The cleavage runs (1) post pubic, close to the bones; (2) in the urethro-vaginal septum; (3) in the rectovaginal septum, and (4) along the anorectal canal,

If the urethral segment falls any considerable distance, only ventral fixation at the rear or top of the pubes will hold the upper urethra and anterior bladder wall. The second segment (vagina, bladder-base, cervix) is the common hernial mass. A convenient nomenclature would be intravaginal cystocele; extravaginal cystocele, protruding beyond the hymen on straining, and complete extrusion, bladder, cervix, uterus, one or all. For the worst cases Dickinson employs ventral fixation of the bladder, whether vaginal hysterectomy is done or not. The recto-anal segment, when very badly prolapsed, particularly in the presence of protrusion of the uterorectal pouch, may call for sigmoid fixation; and the wide-open long outlet of the pelvis may present no tissues out of which a diaphragm can be built, so that flaps from the buttocks may be required.

"Erosio" Portio Vaginalis Uteri.—ADAIR (*Surgery, Gynecology, and Obstetrics*, 1910, x, 337.) presents a brief resume of the various theories advanced to explain the origin of cervical erosions. In his opinion no individual theory embodies an explanation which can be applied to every erosion studied. From his studies of 57 cases he concludes that "erosions are chiefly inflammatory processes showing pictures which vary with the stimulus to their formation and the reaction of the tissue."

The Relation between Myoma of the Uterus and Conception.—OTTO GOETZE (*Ztschr. f. Geburtsh. u. Gynäk.*, 1910, lxvi, 340) includes the opinion of various writers concerning this subject and bases his conclusions upon the study of 105 cases. Small subserous myomas have no influence upon conception. With increasing size, the chances of conception are lessened, although not entirely excluded even by very large tumors. The prognosis varies with the site of the tumor, being most unfavorable in the submucous variety, especially when associated with extensive alterations in the endometrium and hemorrhages, as the result of increasing influence upon the endometrium, interstitial myomas lessen the likelihood of conception. Tumors of the cervix seem to offer greater obstacles than those of the corpus. If pregnancy does take place, myomas increase the danger of abortion. In the absence of other lesions which are conducive to sterility, myomectomy undoubtedly increases the chances of conception, the prognosis being more favorable the less radical the operation required, as in cervical and subserous myomas, the less the alterations in the endometrium, and the earlier the diagnosis is made. If myomectomy is not possible, an interstitial myoma of some size in a woman of thirty years practically excludes any hope of conception.

The Repair of Inaccessible Vesicovaginal Fistulæ following Hysterectomy.—G. G. WARD, JR. (*Surgery, Gynecology, and Obstetrics*, 1910, xi, 22) says that such a fistula is usually small, situated in the vault of an atrophic and contracted vagina, and embedded in the scar tissue which occupies the former position of the cervix, thus rendering operation for its cure extremely difficult, owing to its inaccessibility. The steps essential to cure by the method which he employs are: (1) The differentiation from a urethral fistula by distention of the bladder with an aniline solution. (2) Deep paravaginal incisions (Schuchhardt).

(3) A longitudinal incision of the anterior vaginal wall from the urethra to the vaginal vault through the fistula and extending into the posterior vaginal wall, and a lateral incision extending the full width of the vaginal vault. (4) Thorough separation of the base of the bladder from the entire vagina and vaginal vault. (5) Evisceration of the bladder into the vagina by means of a sound passed through the urethra. (6) Closure of the opening in the bladder separately from the vaginal incision. Suprapubic methods are to be employed only in the presence of failure by the vaginal route, since the latter is less dangerous and offers good chances for cure.

Gynecological Operations on Neurasthenics: Advantages, Disadvantages, Selection of Cases.—EDWARD REYNOLDS (*Boston Med. and Surg. Jour.*, 1910, clxiii, 113) defines neurasthenia as implying merely a state of low resistance to the depressing influences of environment, irrespective of the cause to which this low resistance is due. In attempting to ascertain the cause underlying these chronic conditions, with their manifold complaints, a careful history of the sequence of events, combined with an exact knowledge of the importance of symptoms, offers the best chances of success. In the presence of a demonstrable pelvic lesion, subsequent treatment demands a careful consideration of a possible chronological relation between this lesion and the symptomatology. In the absence of a reasonably close chronological sequence between general and local symptoms, local treatment should be withheld and general measures employed. When neurasthenia has developed secondary to a well-defined lesion, and if such a lesion is curable, operation is recommended. Such an operation should aim to repair rather than to remove the diseased organ, especially in women who have not reached the menopause.

Oliguria and Chronic Uremia in Carcinoma of the Uterus.—H. OFFEIGELD (*Archiv f. Gynäk.*, 1910, xci, 183,) states that chronic uremia is a frequent complication of inoperable carcinoma of the uterus, resulting from ureteral obstruction or from lesions of the kidneys produced by toxic products of the carcinoma. Should a palliative measure be deemed advisable to prolong life, nephrostomy, ureterostomy, or ureterocystoneostomosis will temporarily relieve the oliguria; the additional lesions of the kidneys, however, remain unchanged, thus exerting a deleterious influence upon the whole organism. Since the kidneys are supposed to possess an internal secretion, the author hoped to supply this substance and thus relieve the symptoms of chronic uremia by the administration of a renal extract obtained from the kidneys of beef. In four cases of carcinoma treated in this manner, the symptoms were exaggerated rather than relieved. He advances the idea that extracts of normal human kidneys may be useful, but so far this has not been determined. His conclusion is that animal renal extracts are valueless in alleviating the symptoms of chronic uremia associated with inoperable carcinoma of the uterus.

OTOLOGY.

UNDER THE CHARGE OF

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The Prophylaxis of Deafness in School Children.—F. H. QUIX (*Internationales Archiv f. Schulhygiene*, 1910, vi, No. 4) regards the examination of the ears of all school children, instead of its limitation to the selected cases in which an impairment has already manifested itself, as a matter of great importance. Hartmann's review of the proportion of cases of impaired hearing in school children, beginning with Bezold's classical communication on this subject in 1885, gives an average of 25 per cent. of pupils backward in their studies on account of this sense defect. Of this number very nearly one-half were capable of improvement under treatment (Bezold, 41.7 per cent.; Ostmann, 50 per cent.), but there are no statistics to show the proportion of cases in which the impairment of function could have been prevented by a rational prophylaxis, since, as yet, no provision has been made in the public schools for the more extended special examinations necessary to the institution of preventive measures. Regarding the study of causes as the proper basis for the institution of prophylactic measures, the author makes the following classification of etiological factors in the order of their causative importance: Adenoids, the exanthemas, typhus, parotitis, catarrhal and tuberculous processes in the nose and nasopharynx, hereditary syphilis, and traumas. The examination should include, in addition to the functional tests, an objective determination of existing abnormalities with reference to the past history, the present condition, and the prognosis as regards the resistance capacity; the detection of a disposition toward causative conditions being quite as important to the scholar as the determination of an actual impairment of hearing. The detection of even a moderate degree of tubal closure, for example, is of importance in the light of the changes which may take place in the sound transmitting apparatus, with frequent repetition or immediate continuance of this condition; while the detection of a perforation of the drum-head, consequent upon a past suppurative process, though the hearing may be so nearly normal as to suggest nothing through the subjective examination, is of importance in reference to the hygiene of the individual case; the residual evidences of middle-ear inflammation, cicatrices, atrophic areas, interstitial thickenings, and calcareous deposits in the drumhead are also evidences of a lessened capacity for resistance which should be taken into consideration. The demands of such a special examination are such as not only to take it out of the hands of the teachers, but to place it in those of a competent school physician whose professional acquaintance with the pupils should begin with their admission to the school, and be continued by repetition of the examination at stated intervals, or in individual cases, as occasion demands. The objective should precede the subjective examination, and for the

latter the main dependence is to be placed upon the hearing for the whispered voice, the words used being graded according to their inclusion of soft, medium, and loud consonant sounds. The advantage of this uniform hearing test for school purposes consists not only in its simplicity, in its accuracy of result, as compared with tests with tuning forks and acoumeters, but also in its international application, tests made by Delsaux, Reuter, Niedder, and Wojatschek, giving identical results in French, German, Italian, and Russian. The suggestions embodied in the author's paper are important for the consideration of all otologists in their bearing upon the furtherance of an adequate aural examination in public schools.

The Surgery of the Labyrinth.—GUSTAV ALEXANDER (*Archiv f. Ohrenheilk.*, 1910, lxxxi, Heft 3 and 4), in continuation of his communication at the International Otological Congress in Budapest, on the symptoms and treatment of inflammation of the labyrinth, reports a series of cases, and appends a classification defining the distinction between the complicated and simple cases of suppurative inflammation of the labyrinth. Endocranial implications, of otitic origin, are to be regarded as diseases for which surgery affords, in the great majority, the only assurance for recovery, since they present forms of suppurative inflammation of the meninges which, spreading rapidly, demand speedy operative interference; suppurative inflammations of the labyrinth, however, heal spontaneously in a not inappreciable percentage of cases. To this class belong: (1) The labyrinth inflammations secondary to suppurative cerebrospinal meningitis, in which the middle ear is unaffected and the labyrinth invasion has been effected through the medium of the internal auditory canal. (2) Otitic labyrinthitis, in which the infection is secondary to that of the middle ear, with suppurative implication of the membranous labyrinth, and formation of a labyrinth abscess, the bony capsule and surrounding petrous bone remaining intact. In these cases spontaneous healing may result as the sequence of a resorption of pus, the formation of connective tissue, and, later, osseous obliteration of the labyrinth, or evacuation of the labyrinth abscess into the middle ear through anatomical channels or by means of a fistulous opening. (3) Cases of suppurative labyrinthitis, secondary to middle-ear suppuration, through the medium of a fistulous opening through the tympanic portion of the osseous labyrinth capsule, the remaining portions of the bony labyrinth being intact, in which, unless there is cause for concern in the patient's general condition, spontaneous recovery from the labyrinth suppuration is to be expected, it being understood that recovery does not imply a restoration of function except in a very small percentage of cases, where circumscribed regions of the labyrinth have been spared from the suppurative invasion. A characteristic of all of these cases is the freedom from implication of all of the anatomical channels leading from the labyrinth toward, or into, the cranial cavity, the internal auditory canal, the aqueducts of the cochlea and of the vestibule, and, equally, the integrity of the surrounding barriers of the petrous portion of the temporal bone, including the tip, especially rich in diploetic cells, but having, between it and the anterior portion of the cochlea, an especially thick and compact capsular wall. These cases of otitic labyrinthitis, as contrasted with the cases of meningitic labyrinthitis, the

author classifies as uncomplicated labyrinth suppuration, cases in which, under conservative treatment, recovery is not infrequent. The complicated labyrinth suppuration, however, is one demanding operative interference, and that as speedily as possible upon the determination of symptoms of extension of inflammation to the cranial contents.

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

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The Pathology of the Auriculoventricular Bundle of the Heart.—STERNBERG (*Central. f. allg. Path.*, 1910, xxi, 439) reports an examination in various parts of the bundle of His in 72 hearts of persons dying suddenly of cardiac failure. In about three-quarters of these cases various lesions were found in the conducting bundle, which consisted of hemorrhage, fatty infiltration or degeneration, diffuse inflammatory infiltration, small round-cell infiltration, with or without increase in connective tissue, and abscess formation. Usually the myocardium was affected in a manner similar to the conducting bundle, so that there was no ground for the assumption of an independent pathology for the His bundle. Sternberg thinks that the lesions of the bundle itself play a minor role in the production of sudden death, as disturbances of conduction are so often seen clinically without a fatal termination. The widespread disease of the muscle is, he considers, the causative factor in sudden cardiac death.

The Etiology of Hodgkin's Disease.—FRAENKEL and MUCH (*Munch. med. Woch.*, 1910, lvii, 685) have examined lymph nodes from cases of Hodgkin's disease by means of the antiformin method, with the result that they have found in 9 out of 10 cases a Gram-positive granular bacillus which resembles the tubercle bacillus in morphology. The material from the first two cases was obtained fresh. In the first instance the lymph nodes removed at operation were inoculated into guinea-pigs. At autopsy the picture of guinea-pig tuberculosis was found, with caseation of the mesenteric lymph nodes. In the organs the same Gram-positive granular bacillus was discovered, though there were no acid-fast bacteria. In the second guinea-pig, which was killed, the same condition was discovered. Material that had been recovered from eight other cases of Hodgkin's disease was studied by the antiformin method. In none of these cases had there been any tuberculosis at autopsy, but in seven of the eight cases the granular Gram-positive bacillus could

be demonstrated. These organisms were not acid fast. They were often present only in small numbers. Five cases of lymphatic leukemia were studied in the same manner, and in all of them Gram-positive granular bacilli with the morphology of the tubercle bacillus could be found in the lymph nodes and spleen. In the cases of lymphatic leukemia they were somewhat more numerous than in the cases of Hodgkin's disease. Fraenkel and Much conclude that the organism or group of organisms discovered by them bears a definite etiological relation to Hodgkin's disease and to lymphatic leukemia.

The Relation of Lymph Glands to Fat Metabolism.—STHEEMAN (*Ziegler's Beiträge*, 1910, xlviii, 170) has studied by various histochemical methods the distribution of fat in lymph nodes. He finds that in many animals as well as in man fat is constantly present in the lymph nodes under normal conditions. The fat is distributed in fine granules or is massed together in the protoplasm of the phagocytes. During digestion the mesenteric lymph nodes seem to play an important part in emulsifying and saponifying the fat on its transport from the intestinal wall to the thoracic duct. During periods of hunger or starvation the peripheral lymph nodes assume the same function toward the fat which is carried to the glands from the subcutaneous tissues. The phagocytes seem to exert an actual lipolytic action, for they not only emulsify the fat but probably exert some influence towards splitting it. In pathological conditions fat is also found in the phagocytes of the lymph nodes. During severe acute infections the lipolytic action seems to be decreased. In tuberculosis and even in lymphosarcoma of the lymph nodes the function of the glands toward fat metabolism is not destroyed. After subcutaneous injections of olive oil all the lymph nodes contain great quantities of partly unsaponified, partly saponified fats. Stheeman concludes that the lymph glands are organs one of whose functions it is to prepare fat for digestion. "Assimilation organs" he calls them, which are at the disposal of the nutritional fat as well as the tissue fat.

Compensatory Hypertrophy of the Small Intestine following Resection of Large Portions of the Jejunum and Ileum.—FLINT (*Trans. Conn. State Med. Soc.*, 1910, 283) has studied the effects of resection of large portions of the small intestine in 12 dogs, with special reference to a possible compensation on the part of the remainder of the intestine. He has found that as much as 50 per cent. or even 75 per cent. of the small intestine may be removed without causing death. At first there is severe diarrhœa, ravenous thirst and appetite, but recovery soon takes place, which may be only partial if three-quarters of the intestine is removed. Metabolic studies made upon three of these dogs by Erlanger and Hewlett showed that in these animals there was a marked increase in the excretion of the nitrogenous, fatty, and carbohydrate elements of the food. After compensation takes place digestion goes on as in a normal dog when a rich, easily assimilable diet is given, but should the fats of the food be greatly increased, the digestion is disturbed and the elimination of fats and nitrogen is increased to a point about 25 per cent. above normal. The compensatory mechanism consists in an hypertrophy of the villi of the remaining small intestines, which evidently represents an attempt on the part of the body to enlarge the absorbing

surface of the intestines. There is no actual increase in the number of villi, but such marked hypertrophy of the individual villi that in favorable cases the original epithelial surface of the intestine is restored by the compensatory hypertrophic process. In human beings the resection of large portions of the small intestine is a dangerous operation, for in 40 reported cases in which over 200 cm. of the small intestine has been resected, the mortality was 18 per cent. The human cases behave much like animals, though as yet no regeneration or hypertrophy has been reported. It is probable that patients who have had large portions of the small intestine removed would do best ultimately upon a rich and easily assimilable diet poor in fats and relatively rich in carbohydrates.

Experimental Typhus Fever.—NICOLLE, together with his assistants (*Ann. de l'Inst. Pasteur*, 1909, xxiv, 243), has investigated certain problems in regard to experimental typhus fever. After two unsuccessful attempts to transmit typhus fever to macacus monkeys by inoculating these animals with blood from patients suffering with typhus, they succeeded in producing a typical attack of typhus of seven days, duration in a chimpanzee. The disease terminated in cachexia and death. On the day before the eruption appeared the blood of the chimpanzee was inoculated into a Chinese macacus and produced a typical attack of typhus. The blood of this monkey was found to be infective for the Chinese macacus, but not for other varieties of macacus tried. It was also non-infective for dogs and rats. Moreover, the preliminary inoculation of the Chinese macacus with blood from the human typhus seemed to confer upon this animal an immunity, for it was not susceptible to inoculation of blood of other macacus monkeys suffering from experimental typhus. The disease was transmitted to six macacus monkeys through the bite of fleas that had fed upon monkeys suffering from typhus. During the transmission of the disease from one generation of monkeys to another the virus appeared to decrease in virulence. The serum of convalescing monkeys was not harmless, but seemed to exert some definite toxic action when inoculated into healthy animals. The bacteriological examinations of the blood gave negative results. A study of the leukocytes, however, brought out several points of interest. During the early days of the attack, and beginning on about the fourth day, an extensive degeneration and often actual necrosis of the polymorphonuclear leukocytes of the circulating blood was found, while later in the disease myelocytes and mononuclear cells appeared in considerable numbers.

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GYNECOLOGY.

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ORIGINAL ARTICLES.

URIC ACID IN GOUT.¹

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INTRODUCTION. Up to the present time the only chemical problem considered in gout has been that of uric acid. As yet no other chemical standpoint has been found. Are we on the right track in doing this? Is uric acid really the principal toxic agent in gout, or only one of many? From time to time, especially when there appeared to be no progress in the investigation of the subject, protests arose that research was on the wrong path.

The relations between uric acid and the occurrences in gout become evident in the acute periods. The attacks are certainly connected in some way (yet to be determined) with the accumulation of this substance in the body, and during the attacks the

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output of uric acid is greatly altered. Experiments made with uric-acid injections prove their toxic character; the inflammation and the pains provoked by them resemble in many respects those occurring in attacks of gout.

Though conceding this, von Noorden, a number of years ago, following Ebstein's theory of the formation of uric acid in the bones, expressed the opinion that the deposits of uric acid were quite independent of the general metabolism of uric acid. Although local influences play an important part in gout, this view of von Noorden is easily refuted. The microscope shows clearly that the crystals are first found near the free surface of the cartilage and that they advance slowly toward the deeper layers. Thus, they must pass from the cavity of the joints into the cartilage. Secondly, when a tophus on the finger reaches the size of a chestnut, and even larger, it is impossible to imagine that the enormous masses of sodium urate stored up here could be formed *in loco*, even in the course of many years. The metabolism of connective tissue is much too torpid, and nuclear material, known to be the sole source of uric acid, is contained in only small amounts in the cuticle and neighboring tissues. Moreover, whenever one finds deposits of sodium urate in the body, that is, whenever gout is apparent, there at the same time an excess of this substance occurs in the blood. Although this principle is not reversible, it proves certain connections between the local and the circulating uric acid.

PRELIMINARY NOTES. In reference to uric acid, gentlemen, please remember that in reality we have to deal only with monosodium urate in the fluids within the body. Some authors have assumed the existence of a quadriurate of sodium, or, as we would call it now, of monosodium biurate or hemiurate; others have insisted that in a fluid containing a number of basic molecules like serum, the chemical union of an acid with one of the bases could not be recognized. Physically considered, there exists no monosodium urate in the serum, no more than monosodium carbonate. All these salts are dissociated into their ions, and we have to deal only with sodium, potassium, calcium ions and with uric, chloric, carbonic acid ions, existing side by side. But with the same right with which one speaks in the common language of chemistry of the existence of sodium chloride, of monosodium carbonate, and monosodium phosphate in the serum, with just as much right one may also speak of monosodium urate. Ninety per cent. of the kations in the serum belong to the sodium, only 10 per cent. to potassium, calcium, and so on. In a neutral solution which, in a physico-chemical sense, the serum is, the proportion between kations and anions, or between acids and bases, is such that we can only speak of monosodium carbonate and of monosodium urate. The existence of bisodium urate is just as impossible here as the existence

of bisodium carbonate. It is to Gudzent that we owe the clear exposition of this.

FUNDAMENTAL PRINCIPLES. As compared with former times, we now stand on a firm foundation in regard to our knowledge of the formation of uric acid. This substance is derived from the nuclear purins, adenin, guanin, hypoxanthin, and xanthin. Their transformation into uric acid is the work of hydrolytic, of desamidizing and oxidizing ferments. The ferment which katabolizes uric acid is called the uricolytic ferment. I need not detail these processes, but will refer you to Prof. Mendel's lecture delivered on this subject three years ago before this Harvey Society.

This being established, two questions arise:

1. Whether this intermediate path of metabolism is obligatory in the sense that every molecule of the purin bases must reach the stage of uric acid, or whether adenin or hypoxanthin, and so on can be katabolized without first being converted into uric acid. Thus far the possibility of the latter proposition has never been demonstrated in the organism. Chemical considerations and biological analogies lead us to consider the transformation of purin bases into uric acid as the only process effective in mammals.

2. The second question, whether in mammals there are still other sources of uric acid, is doubtful. No proofs have yet been brought forward of a formation of uric acid from urea and from acids with three-carbon atoms, a process which is of fundamental importance in birds. So we may neglect this kind of synthesis. On the other hand, it is beyond question that purins are newly formed in suckling animals whose food is practically purin-free. It seems improbable that the synthesis effected here starts from urea; we must rather look for a higher amino-acid compound, as a material which can yield purins. It would be very surprising if this synthesis were performed on a larger scale than was needed for the growth and for the renewal of the tissues, that is, for the synthesis of nucleoprotein. I do not think that in this process an excessive formation of purins takes place, or that superfluous material for the formation of uric acid is left over. We may with our present knowledge consider the purins as the only source of uric acid in human metabolism.

We distinguish the exogenous purins ingested with the food from the endogenous derived from the nucleins of the body. By dieting we can make ourselves independent of the great variations in the output of uric acid due to the different amounts of ingested purins. By giving a purin-free food, which need not be absolutely the same every day, the urine will contain endogenous uric acid only. The quantity eliminated, although varying in different men from 0.3 to 0.6 gram, is fairly constant in the same person under normal conditions, thus proving the existence of an equilibrium between the formation and the destruction of uric acid. The simplest conception of this is, not that formation and destruction vary always

in the same sense and proportion, but that both formation and oxidation are constant.

The katabolism of uric acid leads to the formation of allantoin in dogs and rabbits. In man its fate is unknown. In contrast with the results in most animals, human organs have failed to show a distinct uricolytic power. Hence Wiechowsky drew the conclusion that uric acid was indestructible in the human body. He based this opinion also on a second fact, namely, that uric acid injected into the muscles of men is found again almost quantitatively in the urine. Schittenhelm although confirming Wiechowsky's experiments with human *organs*, was able to show that uric acid undergoes destruction in *living* men. When a person, who was in nearly perfect nitrogen equilibrium, was fed with 10 grams of nucleic acid, the output of purin substances was only slightly increased, and instead, an increase of urea (or a substance behaving similarly) was found, and in amount corresponding nearly to that of the nitrogen of the ingested purin compounds. It would be of greatest interest for physiological chemistry to determine what are the intermediate and end-products of the uric acid breakdown; but for the knowledge of gout, this is of less importance. It suffices for the present to know that this toxic substance disappears as such.

If Wiechowsky's opinion were right it would mean a simplification of experiments and of theory, for one unknown component in the complex equation of urate metabolism, the destruction of uric acid, would be eliminated. Recapitulating, one may say that the present foundation for investigations of the metabolism in gout is as follows: We have to deal only with *one* source of uric acid, namely, the purins; and, after excluding the exogenous purins, we find a uniform elimination at certain periods. This we accept as a firm basis for comparison, both as regards the metabolism of healthy men and also with regard to the variations which occur in different periods of gout.

THE FACTS IN GOUT. What are the facts in gout which are established with such accuracy that we can take them as a basis for our consideration? What results are sufficiently probable to be taken into serious discussion? The facts and the probable truths are as follows:

1. The presence of uric acid in the blood.
2. The presence of crystalline deposits.
3. The increased output of uric acid in the attacks of gout. The augmentation can reach from 0.3 to 0.5 gram daily and more, and may sometimes last for a week or even two.
4. A decline in the output of uric acid often precedes the attack of gout, but this diminution is not as marked as the subsequent increase, and its duration is only one or two days.
5. In the intervals between the attacks of gout the elimination of endogenous uric acid is asserted to be lower than in health.

There are doubts whether this statement has been proved beyond question.

6. The elimination of exogenous uric acid is often retarded.

To elucidate the connections between these data it would be necessary to have a complete knowledge on the quantitative side of the following processes in both health and disease:

1. Of the formation of uric acid.
2. Of its destruction.
3. Of its elimination by the kidneys.

From a combination of these three processes would arise a knowledge—

4. Of the accumulation of urates in the body, especially in the blood.

5. We ought to know the conditions of the sodium urate precipitation in the tissues, as well as the conditions for its removal. Herein is included a knowledge of the physical and chemical behavior of sodium urate.

THE FORMATION OF URIC ACID. Is the formation of uric acid increased or is it diminished in gout? In almost every case in which we see an increased output of uric acid, for example, in leukemia and pneumonia, we find an increased destruction of nuclear material, and vice versa. In gout, at least in the intervals and when the patient is given purin-free diet, neither one nor the other is to be observed. The katabolism of nuclear material therefore is certainly not increased.

On the other hand, we have just as little reason to assume a diminished formation. Brugsch and Schittenhelm, it is true, have recently advanced the theory that the total nuclear metabolism in gout is retarded. But even if this were true, I must insist that retardation of metabolism is not in every case identical with diminution. Perhaps in *advanced* stages of the disease, a decrease in the formation of nuclear compounds may take place, due to a kind of cachexia of premature aging. In the experiments made hitherto I miss a clear distinction and separation as to the age and the general state of health. Most of the gouty patients treated in hospitals are in an advanced stage of their illness, and evince signs of cachexia, even when showing a good volume of muscles and of subcutaneous fat. The healthy people, whose nuclein metabolism has been compared with that of the gouty, were generally younger. In order to obtain a more reliable material for the comparison between normal and gouty metabolism, stricter attention ought to be paid to this point regarding age. Bearing this criticism in mind, the following exposition may be considered. In any case it seems to be certain that, in opposition to former opinion, the occurrences in gout cannot be explained by excessive formation of uric acid. In the older days whenever an increased output of uric acid was noticed the cases were mostly those of wealthy people overfed

with meat. Gouty patients are generally hearty eaters. The high amount of uric acid in these people is due to the ingested purins, not to the diathesis. Analogy with obesity produced by polyphagy is striking. The gouty process, though no doubt aggravated by an excess of exogenous purins, does not depend on an increased uric-acid formation.

THE DESTRUCTION OF URIC ACID. In many experiments the twenty-four hour output of uric acid in the urine of gouty men is diminished. So far as this is not due to lessened formation, it proves an increase in the *absolute* quantity of uric acid destroyed. The accumulation in the body does not reach such an extent as to explain the difference of excretion between healthy and gouty men. This difference often reaches 100 mg. in 24 hours. Supposing this quantity were retained in the body day by day for one year only, the total sum would amount to 36 grams. Deposits of such enormous size are extremely rare, at least in Germany. I doubt whether in the majority of cases 10 grams of sodium urate may be extracted from the gouty body. Since the lower quantity of uric acid in the urine is not explained by an accumulation, it must be ascribed to increased destruction. As Brugsch and Schittenhelm rightly suggest, this does not mean absolutely that the oxidizing power of uricolytic ferment is greater than normally or that its quantity is increased. The reason may be that each molecule of uric acid circulates a longer time in the body; thus it is exposed more often to the influence of the oxidizing ferments, and thus there is more chance for its destruction. The investigation of the blood renders it probable that such prolonged circulation of urates really occurs in gout.

The conclusion that the *endogenous* uric acid is katabolized in greater amount is confirmed by the results of experiments in which the fate of *exogenous* purin was studied. In a great number of these observations the output of uric acid after feeding sweetbread, or other nuclein-containing material, was less than in healthy persons. It also is to be remarked here that more time is needed for the elimination of exogenous purins than normally, in spite of the fact that smaller quantities are excreted. Different gouty patients do not behave alike. There are some in whom destruction and elimination are performed in the same length of time and to the same extent as in healthy persons. It would be premature to assume a retardation of the purin metabolism as being the constant rule. I refer again to the above-mentioned objections concerning the influence of age and general state of health upon the purin metabolism.

THE EXCRETION OF URIC ACID. The excretion of uric acid by the kidneys depends, like that of any other substance, on two factors. The elimination can be diminished when the secretory power of the kidney is lessened; and it can be prevented also when the substance in question is united to another complex and thus bound.

In nephritis elimination of uric acid is markedly disturbed. Thus,

during favorable periods, even when no other substance is retained (in any amount worth mentioning), some milligrams of uric acid are always present in the blood of the nephritic patient. It seems to me as though the special capacity for the excretion of urates is more limited and can more easily become deficient, than any other function of this organ. I will try to explain this.

In administering an excess of any substance, the level of its end-products rises in the blood. This is due to the fact that the output by the kidney does not keep pace with the influx into the blood. But though with every other substance the level rises only by a small amount, with *uric acid* it may rise to ten times its normal height. While scarcely $\frac{1}{2}$ milligram is contained in 100 c.c. of normal blood, Weintraud found 5 milligrams after feeding with an excess of sweetbreads.

I may now speak of the second factor, that is, the preventing of the elimination of a substance by its chemical combination with another. Such a theory has been offered in order to explain the non-excretion of sugar in the healthy organism. Minkowski tried to introduce this idea into the theory of gout. He assumed a chemical union of uric acid with a nucleic acid. But the search for such a compound in the blood has not been successful. Gudzent, on applying Michaelis' method of compensation to the dialysis of gouty blood, was able to show that the urates exist only in the free state. I might also mention Garrod's thread experiment as speaking against any organic union. Acetic acid, which sets free all uric acid in the serum, or at least the greatest part, is an extremely weak acid, its strength being some hundred times less than that of hydrochloric acid. Under the conditions of the thread experiment it would not suffice to split any organic union.

The hypothesis of Minkowski having been thus refuted, Gudzent showed another possibility. By physico-chemical methods he pointed out that the sodium urate exists in two modifications, which differ only in their solubility. He ascribes the existence of these two forms to a difference in the chemical structure, to a tautomerism. The lactam form, that is the substance having the formula which is generally used for the structure of uric acid, is the more soluble one, but tends to pass into the lactim form, which is less soluble. If the difference in solubility of the sodium urates is really due to a difference in the chemical structure, and not purely to physical reasons, one could imagine that the tautomeric forms would behave differently in regard to their excretion by the kidneys. Experiments in this direction have not been performed.

URIC ACID IN THE BLOOD. Normal blood is practically free from uric acid. In gout it can contain 5 to 10 mg. per 100 c.c. after a mixed diet has been taken; following a purin-free diet the amount is lower, being from 2 to 4 mg., but in no case is uric acid absent. Its presence in gout cannot be explained by an excessive pro-

duction of uric acid, as is the case in leukemia and in pneumonia. This conclusion, though it is contrary to the opinions of a former time, is beyond doubt.

It can be attributed chiefly or partly to a passive retention in those cases in which the kidneys are suffering, either from the beginning—what has been called kidney gout (Nierengicht)—or in later stages of the disease. On this point no controversy exists between the different authors. But how is the presence of uric acid to be explained in those cases in which the most accurate research does not reveal any sign of nephritis? The answer is only to be given conditionally.

If neither the formation of uric acid is increased, nor its destruction greatly diminished—and these two conditions seem to be realized in gout—if, moreover, the uric acid is not prevented by a chemical union or by an abnormal structure from passing into the urine, only one conclusion is possible. The retention is due to a deficient and restricted secretory power of the kidneys.

The existence of such a renal inadequacy does not mean a real nephritis. I think it possible that a single function of this organ can become almost exclusively insufficient. Later on, real damage to the kidney and a nephritis frequently follow.

As stated already by Garrod, uric acid is present also in lead poisoning. Here, as in gout, it is present at a time when no sign of nephritis can be noticed. Concerning this phenomenon, resembling that in gout, one may assume the same explanation, namely, a deficiency in the secretory power of the kidneys, or a kind of incipient and latent nephritis.

If one is not willing to accept the above explanation for the very early stages of gout, because of the absence of albuminuria, he must deny it also for the first periods of lead poisoning. Whatever interpretation avails in gout must also be admitted for lead intoxication. *In any case the mechanism of the accumulation of urates in the gouty blood is not a specific phenomenon of gout.*

Brugsch opposes this explanation on account of an experiment in which uric acid injected into the muscles of a gouty patient was eliminated just as completely and quickly as in a healthy man. I do not consider this objection to be conclusive. The gouty kidney, although not able to eliminate one gram of urates quickly enough on the *normal* level of urates in blood, might accomplish this task very well at the higher level already existing before the injection of uric acid. That this conception is right Widal has obviously proved by the example of the behavior of urea in nephritis.

Brugsch and Schittenhelm fall to a somewhat mystical explanation. They ascribe the accumulation of urates in the blood to a diminished destruction. But when a substance has once entered the blood, its elimination depends *only* on the relation between this fluid and the kidneys. I think the following argument will be convincing. On feeding sweetbreads, or during the absorption of

pneumonic exudates, the blood contains just as large a quantity of urates as does that of a gouty patient. Now, persons who do not suffer from gout will eliminate the excess of urates within a few days, and, even when adhering to a mixed diet, their blood will soon be free from urates. In gout, on the contrary, notwithstanding the ingestion of a purin-free diet, under the influence of which the formation and the influx of uric acid into the blood is much lower, uric acid will by no means disappear from the blood. Brugsch and Schittenhelm ascribe this to a retarded decomposition, though conceding that the total amount of uric acid breakdown is above the normal. Something is lacking in their theory, and they seem themselves to be aware of it. Although denying that the threshold (Schwellenwert) of the kidney for the output of urates is elevated in gout, they speak of a certain torpidity of this organ.

The deduction which ascribes the retention of uric acid to a damaged function of the kidneys, as enunciated by Garrod and adopted since by several authors, is rather repugnant to me as well as to pathologists in general. The disturbance which affects the entire organism would, according to this opinion, depend principally on the *passive* retention of a single metabolic product. This conception is not very satisfactory. I would be very pleased, indeed, if any other solution of the problem could be found. However, *rebus sic stantibus*, and without fixing my opinion for the future, I find no other solution for the problem than that given above.

This interpretation might terminate the unpleasant dualism in the theory of gout. The distinction between a primary metabolic and a primary kidney gout, which has always found supporters, from Garrod down to Brugsch and Schittenhelm, would become unnecessary by adopting this interpretation.

But against the doctrine of gout being due to deficient kidney functions, clinical doubts arise which we are unable entirely to remove. Why does not gout appear in each case of nephritis, why not in leukemia in which we always find an excess of uric acid in the blood? Many cases of interstitial nephritis progress so slowly that secondary changes, such as the deposition of urates and other abnormal phenomena, might have time to develop. Is perhaps the retention of uric acid present only in the later stages of contracting kidneys? We know nothing certain about this, nor about the supposed deficiency of the kidneys in gout. Does the condition reach back to youth, or even to childhood? The deficiency in that case would have lasted much longer than in any case of nephritis. At any rate, we must emphasize the fact that in many autopsies on uremic subjects concretions are found in the joints, without any history that the patients had ever suffered from primary gout. There is no doubt that organs other than the kidneys must play an important part in the pathogenesis of gout.

Of all the tissues, only the *joints* and the part they play in the

pathology of gout can be discussed in detail. Are the cartilages and the connective tissues implicated only in a passive way in gout, or are they active? Further questions to be answered are the following: By what mechanism and at what period does the deposition occur? What symptoms are produced by the precipitation of crystals, and what happens to the crystals during the paroxysm?

Contrary to the opinion of Ebstein, we may at present take for granted that the deposition of urates does not occur in necrotic, but only in living tissue (Minkowski, Freudweiler). And also in these deposition can only occur if the liquids which circulate in them are saturated with sodium urate. As to this point, whether the amount of urate of sodium in the blood corresponds to the saturation point, the opinions of most authors are or were erroneous. It was generally believed that the serum of the gouty patient is not saturated with urate of sodium. This assumption has been put forward on account of the experiments of G. Klemperer. He observed that 100 c.c. of normal serum can dissolve 150 to 200 mg. of uric acid, that is, ten times more than it ever contains during life. The serum of a gouty patient behaved in the same manner. This observation is correct—of that there is no question. But Klemperer failed to observe the reaction to its end; if he had done so, he would have seen after some time the abundant precipitation of urates. Serum, indeed, has the power of dissolving a good deal of uric acid by transforming it into urate of sodium, but only a small amount of the sodium salt is kept in solution. The problem has been attacked from a wrong direction. The biological question is not how much uric acid can be transformed by the alkalies of serum into urate of sodium, but how much sodium urate the serum is able to take up without precipitation. Roberts, in 1890, carried out experiments, and by the use of a correct method found that serum holds only a few milligrams of urate of sodium in solution. The figures found by Gudzent twenty years later were almost identical with those of Roberts, and with those Gudzent had in advance calculated theoretically that 100 grams of serum is saturated when containing 8 mg. of urate of sodium. If we apply these figures to the free acid instead of to urate of sodium, and to blood instead of to serum, we are surprised to see that 100 grams of blood is saturated when it contains 4 milligrams of uric acid. Such an amount has, indeed, been found in the blood of people suffering from severe gout, when on a mixed diet.

As to the point of saturation the conditions for precipitation are nearly always present. In the circulating blood, however, precipitation never takes place; it is prevented by its continuous movement and by the perpetual exchange of the urate molecules. While some of them pass to the urine, others enter the blood from the organs.

THE PRECIPITATION OF URATE OF SODIUM. The conditions for precipitation are much more favorable within the lymphatics and

within the synovia of the articular cavities than elsewhere, for here the flow of liquids is very slow. I myself found 4 and 6 milligrams of uric acid in 100 c.c. of the fluid aspirated from inflamed knee-joints. But in spite of this saturated state one rarely finds crystals in suspension, and when such are encountered they may, perhaps, have originated from the impregnated cartilages which have undergone destruction, or from tophi which have forced a way into the articular cavity. As a rule, crystallization takes place only in the organized tissue.

By many it has been taken for granted that the cartilages possess a *specific* power to attract dissolved urate of sodium and to bring it to crystallization. However, the phenomenon can also be produced by excised cartilaginous tissue. This was shown by Roberts many years ago, and later by Almagia and Brugsch. Tarsal bones of a pig were suspended in phials charged with a saturated solution of urates; after a few days they were encrusted with needles and presented an aspect which, in intensity and distribution of deposits, resembled that of a gouty joint. The process of precipitation is thus not a vital one, but is purely passive, brought on by certain chemical relations and properties still existing in the dead cartilaginous tissue. But possibly even this chemical reaction is not of a complicated order. Roberts, in a purely experimental way, showed that the solubility of sodium urate decreases with increasing concentration of sodium salts in the liquid. The theory of solution agrees fully with the actual experiment. An addition of 0.2 per cent. of sodium chloride to a saturated solution of urate of sodium brings about precipitation. Roberts and Gudzent noted that cartilage, tendons, etc., are richer in sodium salts than the blood serum. Their sodium content reckoned as sodium chloride rises to 0.9 per cent., while in serum it is only 0.7 per cent. When the lymph saturated with urate of sodium penetrates into the cartilaginous tissue where the concentration of the sodium ions is higher, a state of supersaturation is brought about, and precipitation can take place. In this hypothesis the supposition is made that the sodium exists in the state of ions in the cartilages. Whether this is true or not is unknown. If it does not thus exist, if it be united to an organic compound, the explanation of Roberts and Gudzent would not hold good.

In response to the question why precipitation does not occur in all joints—their chemical composition being the same everywhere—we must refer to mechanical and thermal injuries, the influence of which on the localization is clearly proved by daily experience, even though we do not find such explanations satisfactory.

But the nephritic patient is exposed to the same influences. Why does not precipitation occur in every man suffering from contracting kidneys? For the second time we are obliged to put this question. If the retention of uric acid in the blood is a passive process,

if the deposition within the tissues is a purely physical process, by what properties is gout then to be characterized?

There must be an active element in its pathogenesis belonging exclusively to the gouty diathesis. What then is this active principle? Science as yet gives no answer to this question, which touches the kernel of the problem. Therefore, I will not attempt to present any hypothesis. Surely an hereditary influence exists in gout and a neuro-pathological influence is present besides the chemical or humoral-pathological. The clinician must always be aware of this. But so long as we cannot determine the mechanism by which the nerves act on the metabolism in gout, no scientific advantage results from emphasizing such an influence.

All organs yielding or destroying uric acid (and they are many) were at one time thought to be implicated in the phenomena of gout. Thus, a predominant part was formerly attributed to the liver, to the bowels, or to the spleen, etc. But their influence, if indeed any exists, is not a directly controlling one over the uric acid metabolism. It is for the present worthless to search for increased or for decreased destruction in the single organs, since we know that *as a total* the uric acid metabolism always remains within the ordinary limits. If muscular work prevents paroxysms or lessens their violence this need not be referred to an increased destruction of uric acid, but rather to an immediate action on the joints, changing the quantity of synovial liquid or its composition, or the rapidity of its circulation. The action of other organs too might be indirect.

Thus the so much sought for active principle which causes gout remains a mystery, not to be unravelled by our present means. Leaving the solution of the problem to the future, we return to the fate of urate deposits. We can discuss apart this question without regard to the problems of gouty diathesis and pathogenesis.

THE RELATION BETWEEN THE ATTACKS AND THE URATE DEPOSITS.
At what time does precipitation take place? Is it a chronic process going on continuously, or does it depend upon attacks and in what manner is it connected with them? When considering those tophi, the fate of which we can trace with the eye, we know that they may appear, grow, and disappear without the bearer knowing anything about it. Especially the larger deposits, those upon the hands, grow with hardly any inflammatory reaction. But this fact does not absolutely exclude a relation between the precipitating process and the attack. The same process which on slow development causes no strong reaction, may induce the most violent symptoms if the onset is one of great intensity.

According to Garrod the attack is provoked by a sudden precipitation of crystals in the tissues. The attack consists merely of such deposition of urates and of the inflammation induced by their presence. The deposits, once formed, remain for a long time, often throughout life. "When crystallization of the salt takes place

in any tissue, inflammation is suddenly lit up by its presence and a paroxysm of gout ensues." Roberts is of the same opinion.

There is one objection which renders it difficult to consent in this respect to the authority of the eminent English clinician. One of the chief rules of chemistry *corpora non agunt nisi soluta* is applicable also to the conditions in the organism. If the uric acid salt is precipitated, the chemical influence of the solid material upon the tissues stops instantly and does not reappear until it is dissolved again. In the meantime its action is purely physical. The mechanical irritation may perhaps be stronger at the moment of crystallization and during the growth of the crystals than in periods of absolute rest. But the pressure which the crystals exert upon the tissues is scarcely sufficient to bring about a serious reaction. Garrod's opinion is just as improbable to me as the hypothesis which refers the symptoms of bronchial asthma to an irritation of the air conduits by Charcot-Leyden crystals. In opposition to the English authors, I am rather inclined to ascribe the irritation to the dissolved urates. According to this conception a sudden increase of their concentration would induce the inflammation.

This supposed rise of the amount of urates within the synovia could be brought about in a twofold manner. According to Garrod's opinion it is only a part of the general urate accumulation in the whole body, induced by a deficient excretion. The urate molecules would pass from the serum to the synovia and thence to the cartilages. However, a contrary conception could also be supported. A rapid solution of the deposits might lead to an increased concentration in the synovial liquid, thus perhaps explaining the violence of reaction better than the hypothesis of Garrod. As to the question why a solution of deposits should occur so rapidly, I own I am not able to reply.

The above conception is an elaboration of Pfeiffer's ideas somewhat changed. In opposition to Garrod, Pfeiffer considered the attack as consisting of a solution and removal of the deposits of urate. He based his opinion upon reasons which do not seem to me to be justifiable. Still his idea as a whole seems to me probable, and for the two following reasons:

1. The inflammation spreads far beyond the places of the crystalline deposits. One may find an aspect of the skin fully resembling a phlegmon, and even a severe lymphangitis, which, though aseptic, has sometimes misled the surgeon. This proves that an irritating substance is carried away from the afflicted joints. If the sodium urate is really the inflammatory agent in the joints, it seems likely that the irritation of the more distant tissues is caused by the same substance, carried away through the lymphatics.

2. The second reason in favor of Pfeiffer's views is the excess of endogenous uric acid excreted during the attack. The excess is far greater than the diminution preceding the paroxysm. In one

of my observations the surplus eliminated in eight days of a violent attack amounted to more than 3 grams. Although the origin of these urates cannot be pointed out with accuracy, it may probably be attributed, in whole or in part, to a solution of the crystalline deposits.

I might also lay stress upon the fact that, in aspirating the joint exudate as completely as possible, the last portions, originating from the interior parts of the cavity, are always found to be richer in leukocytes than the first portions. And it is well known, that leukocytes are the instruments for attacking the urate crystals as well as the vehicles for their removal. Perhaps the theory of Garrod and that of Pfeiffer might be combined in such a way as to assume that a general retention of urates provokes the outbreak of an attack, and that the inflammation which follows leads to a removal of the deposits.

PECULIAR EXCITING CAUSES OF THE ATTACKS. The accumulation of uric acid in the fluids of the body, supposed by Garrod to precede and to provoke the attack, has not yet been demonstrated by analysis of the blood itself. If it were possible to determine the uric acid in the blood day by day before and during the paroxysm, we would be able to judge the part played by the accumulation of urates better than we can now. We are at present obliged to rely upon analysis of the urine. The decrease of the uric acid output in the twenty-four hours prior to the attack, which amounts to from 100 to 200 mg., may be interpreted as meaning an accumulation in the body; but sometimes this decrease is altogether lacking. The best support of this part of Garrod's theory is to be found in the more recent observations that consumption of sweetbread *sometimes* brings about the paroxysm. It may be asked whether this coincidence is not merely accidental. In spite of such doubts and gaps, this part of Garrod's doctrine is generally acknowledged and accepted.

However, this is not true with regard to the second part of his theory. Garrod assumed a decreased alkalinity of the blood to be the second cause exciting the gouty attack. *This part of his doctrine should be dropped entirely.* It is refuted by actual examination of the gouty blood as well as by proofs in the test-tube, and it is contradicted also by the doctrine of physical chemistry. In measuring the alkalinity of the blood by means of titration in more than twelve patients before, during, and after the paroxysm, and also during the intervals, I failed at any time to find any marked difference. Moreover, all chemical analogies teach us that an addition of hydrochloric acid to the solution of any salt may bring about precipitation of the *free* acid, but never that of the *salt*. If we had to deal with bisodium urate, the addition of an acid would produce its conversion into monosodium urate, and this, being less soluble than the original salt, would crystallize out. This would be the

same process as the precipitation of monosodium sulphate produced by adding sulphuric acid to a solution of neutral sodium sulphate. But please remember, gentlemen, that in the serum only monosodium urate is present, which, according to the above exposition, is not precipitated as such by acids.

Roberts' test-tube experiments correspond fully with these theoretical deductions. Serum contains about 0.5 per cent. of sodium chloride and 0.2 per cent. of monosodium carbonate. The addition of hydrochloric or acetic acid to serum saturated with urate of sodium brings about a precipitation of uric acid. If, on the other hand, sodium carbonate be removed from the serum by dialysis, not the slightest crystallization occurs, although the serum has lost its alkalinity. On the other hand, the addition of monosodium carbonate to the serum causes precipitation, although this be contrary to Garrod's opinion, and in spite of the high increase of the so-called alkalinity. The solubility and the precipitation of urate of sodium have nothing at all to do with the alkalinity, but depend merely on the concentration of sodium ions or salts in the solution. Indeed, the addition of sodium chloride effects a precipitation just as well as does monosodium carbonate.

The question of diminishing alkalinity is of the utmost importance for the precipitation of uric *acid* in urine; it is predominant in the pathogenesis of *gravel*, but it must be excluded entirely from the theory of gout. It has to be replaced by the factor of salt concentration, and especially of the concentration in sodium ions. Please remember, gentlemen, in connection with these explanations, the conception of Roberts that it is the high amount of sodium salts in the connective tissue which very likely determines the place of the crystallization of urates.

It will be hard for many to drop entirely the doctrine of the importance of a varying alkalinity of the blood in gout. One may feel inclined, perhaps, to found his conservatism on the valuable experiments of Loghem. This Dutch scientist has found that deposits of uric acid, produced by hypodermic injections in the rabbit, are soon converted into deposits of urate of sodium, and that this transformation is followed by a serious inflammation. In dogs this transformation is not observed, nor any inflammation. The metabolism of the rabbit kept on green food is, roughly speaking, an alkaline one. In the same sense, we might apply the term of an acid metabolism to a dog fed with meat. According to this difference the fate of uric acid injected varies in the two species. But if the dog has been given 20 grams of sodium carbonate, his metabolism becomes more alkaline, and the conversion of the uric acid into urate of sodium takes place exactly as in the rabbit. Vice versa, in the rabbit it is prevented by administering hydrochloric acid. The results of the older experiments of Pfeiffer and the later ones of Silbergleit coincide fully with those of Loghem.

In these experiments the influence of acids and alkalies upon the chemical occurrences in the body are evident. In many respects these experiments are of high value, and have justly attracted attention. However, the observations have nothing to do with the conditions in gout. In Loghem's experiments an entirely different problem was attacked, namely, the transformation of uric acid into urate of sodium. It is obvious that the transformation is favored by an excess of alkalies in the body, as well as in the test-tube, and that it is retarded or prevented by an increase of acid substances alike in the body and in the chemist's phial. As to the solubility and precipitation of urate of sodium, Loghem's experiments prove just as little as Klemperer's experiments about the degree of saturation of serum with urate of sodium.

THERAPEUTICS. If I now consider the therapeutics of gout, I must of course confine myself to the discussion of such points as bear relation to the metabolism of uric acid.

The two drugs which are the most efficacious in the paroxysm, colchicum and salicylate, behave entirely differently as regards the elimination of uric acid. Salicylates in sufficient doses increase the output of uric acid materially, by half a gram and more daily. This effect, however, seems to disappear within a few days. Colchicum, which, no doubt, is the stronger remedy, produces no change, or, if so, it diminishes the quantity of uric acid elimination. I do not believe that these two drugs, the chemical effects of which are so different, owe their efficacy to the same pharmacological action. One should try to define the mechanism of their action. Setting aside their soothing capacity, I shall only discuss their action upon the uric acid within the body.

If, according to Pfeiffer's opinion, the attack were a process of solution and removal of urates, one could conceive that salicylates favor the elimination, since increased uric acid output follows the administration of these substances. But we do not know whether this increased output originates from the deposits. Even healthy persons when taking salicylates show a slight increase of uric acid elimination. Comparative experiments with this remedy ought to be made on a large scale upon healthy and gouty people.

As to colchicum, one might think that it inhibits the process of solution, thus putting an end to the inflammation and to the paroxysm. Its effect is certainly more rapid and more intense than that of sodium salicylate. If this conception were right the colchicum would be only a palliative for the attack, while the salicylates, in spite of their slower action, would be the preferable remedy. It is well known that colchicum is useless in chronic gout. If the attack be interpreted in the sense of Garrod, the efficacy of both drugs would have to be explained otherwise. A discussion of this subject bears as yet the character of mere conjecture. Therefore, I do not wish to enter into details. I have felt that the ideas were

worth mentioning in order to encourage investigations on these points.

Alkalies and acids are not given during the attack, at least not in large quantities. However, considering the importance of these substances in chronic gout, their application should be tried and observed during the paroxysm also. In recommending them I do not expect any therapeutic effect. Indeed, in one of my patients the largest doses of hydrochloric acid did not influence either the pains or the inflammation, which is contrary to the results observed in the experiments of Loghem. In administering alkaline carbonates during the attack, I do not expect a curative effect either. I merely think that the comparative investigation of the action of acids and of alkalies during the attack should also throw some light upon their action in the chronic stages.

In the therapeutics of chronic gout, restriction of meat in the diet has been in use since olden times. This treatment is older than our recent knowledge of uric-acid metabolism. In lessening the formation of exogenous uric acid, we only practise today what the old physicians practised with less precise ideas. However, the extremists of today do not even go so far as to forbid meat entirely. Empiricism shows that the disadvantages induced by an exclusive lacto-vegetarian diet prevail over the benefits which could be expected from a diminished formation of uric acid. Generally we prescribe a diet poor in purins. Investigations of the purin metabolism during years of strict adherence to such a diet will teach us to indicate its application with more accuracy. Repeated analyses of the purin compounds in the blood are needed as well as balances of the purin intake and output, and also repeated investigations of the behavior of ingested nucleic acids. Hospital patients are not very well fitted for such researches which have to be extended for years. It is fortunate that wealthy patients of today are inclined to enter the clinics and sanatoria, and willingly to undergo longer observation. They have an appreciation of the importance of such investigations. However, it will take a decade at least before sufficient data concerning the behavior of uric acid in the urine, blood, etc., collected from a sufficient number of patients, will be at our disposal. We can look forward to this time with great hope.

Of all remedies deemed useful in chronic gout, alkalies have for centuries been applied more than all others. Two theories as to their value have existed. Regarding the first, it was believed that alkalies dissolve the concretions of urates within the body. I have already explained to you that this idea has been entirely refuted by modern research. The second quality ascribed to the alkalies was their power of facilitating the output of uric acid. This surely should be of benefit. But experiments carried out in this direction do not speak at all in favor of the conception. In therapeutics,

however, the first principle for the practitioner as well as for the scientific observer is to observe and to judge therapeutic effects with impartiality, leaving aside both prejudice and theory. If empiricism should speak in favor of the alkalies, another theory is required, without need of change in therapeutic treatment.

Cool judgment, however, is more difficult in the therapeutics of gout than in any other disease. There is a lack of a pronounced criterion by which we may measure the effects of our prescriptions. In diabetes we measure the amount of sugar eliminated, in obesity the changes of weight. In nephritis, and in cirrhosis of the liver, and in diseases of the circulation, the increase or decrease of effusions and the height of the blood pressure represent the criteria of therapeutics. Even in tuberculosis and in syphilis, the course of which is so difficult to judge, there are still better points of support for judgment than in chronic gout. As yet we are allowed to judge the results of therapeutic action only by the measure of diminished urate of sodium excretion in the urine. Probably a diminished amount of urates in the blood represents a standard of improvement, but as yet this criterion is not available, and for obvious reasons. Thus, the measure by which we may now judge of lasting improvement consists merely in a postponement of the attacks, in a lessened intensity of the paroxysm, and in a diminution of chronic troubles. Regarding this point I can only repeat Roberts' words: "The incidence of diathesis even in fairly typical cases exhibits a waviness, an afflux and reflux, which is very puzzling. In the less typical cases the irregularity is such as to baffle all explanation. In most instances the manifestations become intensified with advancing years, but sometimes the converse is observed. All these perplexing vagaries are within the compass of the natural history of the disorder."

Even if a physician may dare ascribe the improvement of a gouty patient's health not to nature itself, but to his own prescriptions, to which of them is he allowed to attribute this success?

All procedures which we believe to be beneficial in gout, namely, the restriction of meat diet, the choice of green food, muscular exercise, the use of baths, all these prescriptions are generally given at the same time and accompanied by the administration of drugs; and even these the most conservative physician and patient will change time and again. Similar objections are to be borne in mind in judging the effect of alkalies. Roberts, in whom scientific criticism was united with the abilities of a born physician, asserts that in a long experience he had never seen any distinct improvement even after administering alkalies for many years.

What remedy can be substituted for alkalies? You all know, gentlemen, that a German practitioner, Falkenstein, has pleaded for the entire abolition of alkaline treatment and recommended instead the administration of hydrochloric acid. His ideas of gout and of its therapeutics stand on a very weak foundation. However,

success is the decisive factor. Falkenstein reports that after years of severe trouble he finally got rid of his pains by the use of hydrochloric acid, without having changed his mode of living, his diet, or his habits. Such a report deserves every attention, even though this new therapeutic method might not benefit every patient. Falkenstein asserts that he has obtained good results in many patients. Other physicians have been less successful. Thus, we must leave time for further observations.

I wish to add a few more words regarding the use of mineral springs. Physicians are inclined at present to ascribe the undoubted efficiency of mineral waters not to the content of salts, but to the emanations of radio-active substances. Gudzent has observed that radio-emanation was able to destroy uric acid. It has been hoped that such influence is also active in the organism of gouty patients. Since the emanation leaves the body rapidly with the expired air, Löwenthal constructed a respiration chamber, in which the amount of emanation was kept at a high level. Thus, the quantity of radio-emanation from men rose to 150,000 units. Preliminary experiments were carried out last winter by Löwenthal and Gudzent in the clinic of Prof. His. The results have not been published in detail, so judgment is somewhat difficult. In healthy persons the output of uric acid was materially increased, but gouty patients behaved differently. There was a marked improvement of health, but it was not possible to refer this to a distinct change in the uric acid metabolism. In experiments with animals, however, the influence of radio-emanation was more conspicuous. The symptoms of inflammation produced by hypodermic injections of uric acid in the rabbit were modified under the influence of the emanations; leukocytosis and phagocytosis were retarded for several days. By this observation the marked influence of radio-emanation on the occurrences within the organism is established beyond every doubt. It may be hoped that investigations of this kind will advance our knowledge of theory as well as of therapeutics. Thanks to Löwenthal's ingenious apparatus, it will soon be possible for any hospital to avail itself of these new resources.

Since the production and destruction of uric acid, like that of other chemical substances, are the work of protoplasm, it is for future research to study the lesions in the protoplasm itself, and to reveal the mechanism which leads to a derangement of the metabolism. At present we only recognize the results and the chemical products of this derangement. In gout also the researches must rise from the present level to investigations of a higher order. But this is the same in every field of pathological metabolism. When, on looking back after a lapse of twenty future years, we shall have advanced into a more profound region of knowledge, we shall not regard the older investigations on uric acid as having been done in vain.

THE ELECTROCARDIOGRAM IN CLINICAL MEDICINE.

II. THE ELECTROCARDIOGRAM IN SOME FAMILIAR DISEASES OF THE
HEART.

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IN the preceding section of this communication¹ we have seen that the electrocardiogram in health is a curve whose general character, though subject to individual variations, is much the same in all normal persons. As might be expected, this curve is subject to very marked alteration in various diseases of the heart, and for the practical physician it becomes a matter of great interest to know what information, expressed in terms of anatomical change or alteration of function, can be derived from the study of the pathological electrocardiogram.

In considering the factors which bring about change in the form of the electrical curve, it must be constantly borne in mind that this curve is purely the expression of changes in the electrical condition of the heart, due to muscular activity. Movements of the blood or mechanical disturbances of valves have no direct effect on this record.

It has been previously shown that the character of the curve varies with the points of the body surface from which the current is led off. A theoretical consideration of the physical laws which determine the spread of potential would carry us too far afield. It may be stated as an observed fact that variations in the position of the heart within the chest will also cause marked changes in the form of the electrocardiogram.² Similarly, marked changes in the shape of the muscle mass affect the curve. Still more striking variations are those caused by contractions which originate in abnormal situations and pursue an abnormal course through the muscle.

We shall present records of some of the more common of these conditions with such comment on their interpretation and significance as seems desirable from the standpoint of the practitioner of medicine.

HYPERTROPHY. Our knowledge of this subject is at present largely empirical, and analysis of the exact conditions which bring about the observed changes is beset with very considerable difficul-

¹ AMER. JOUR. MED. SCI., 1910, cxi, 408.² Einthoven, Weiteres über das Elektrokardiogramm, *Pflüger's Archiv*, 1908, cxxii, 533.

ties. Further study may eventually permit such an analysis, but for the present we shall confine ourselves to a description of the form of the curves with which we find hypertrophies associated.

As has been previously shown,³ in leading the current from any pair of the three extremities customarily chosen, the three principal peaks, P, R, and T, are usually directed upward in normal subjects. The tall peak R is of especial interest in hypertrophy, and we shall refer to R in lead I as R I, in lead II as R II, etc. Normally all three are directed upward, and of the three, R II is usually of greatest height, R III of least. It has been shown by Einthoven,⁴ and confirmed by others, that in hypertrophy of the right ventricle, R I is very small in extent upward, or may be directed downward, usually the latter in well-marked cases; at the same time R III is directed upward, and is relatively of greater magnitude than in normal subjects (Fig. 1). In hypertrophy of the left ventricle, the opposite condition obtains, R I being directed upward, and often of enormous height, while R III is directed downward, frequently to the extent of 2 cm. (or 2 millivolts) (Fig. 2).

As before mentioned the theoretical explanation of these facts is difficult, and in the absence of more definite knowledge, extensive speculation would be unprofitable. The empirically determined facts that a downward directed R I with upward directed R III signifies right ventricular hypertrophy, and that an upward directed R I with downward directed R III means left hypertrophy, are of the greatest clinical significance. While in most cases the ordinary methods of physical examination suffice for a diagnosis of left hypertrophy, the determination of right hypertrophy is not infrequently a matter of much uncertainty, and with thick chest walls, emphysematous lungs, or in the presence of fluid, consolidation, or newgrowths, the difficulty may be unsurmountable.

So far as we know at present, the only conditions, aside from hypertrophy, which can produce a similar electrocardiogram, are changes in position of the heart in the chest and lesions of one limb of the auriculoventricular bundle. It has been found by us that to produce, by change in position of the normal heart, changes comparable to those caused by hypertrophy, requires a very considerable displacement of the organ. As this will form the subject of a subsequent communication, it will not be dealt with in detail here. Such anomalies of position, however, are of comparatively infrequent occurrence as congenital phenomena, and, as a rule, pathological conditions which could cause marked alteration in the position of the heart present little difficulty in diagnosis. We shall have occasion to consider lesions of one limb of the bundle of His a little later.

³ James and Williams, *The Electrocardiogram in Clinical Medicine*, part I, *AMER. JOUR. MED. SCI.*, 1910, cxi, 408.

⁴ *Le Télecardiogramme*, *Archiv. internat. de Physiol.*, 1906, iv, 147; *Weiteres über das Elektrokardiogramm*, loc. cit., S. 553.

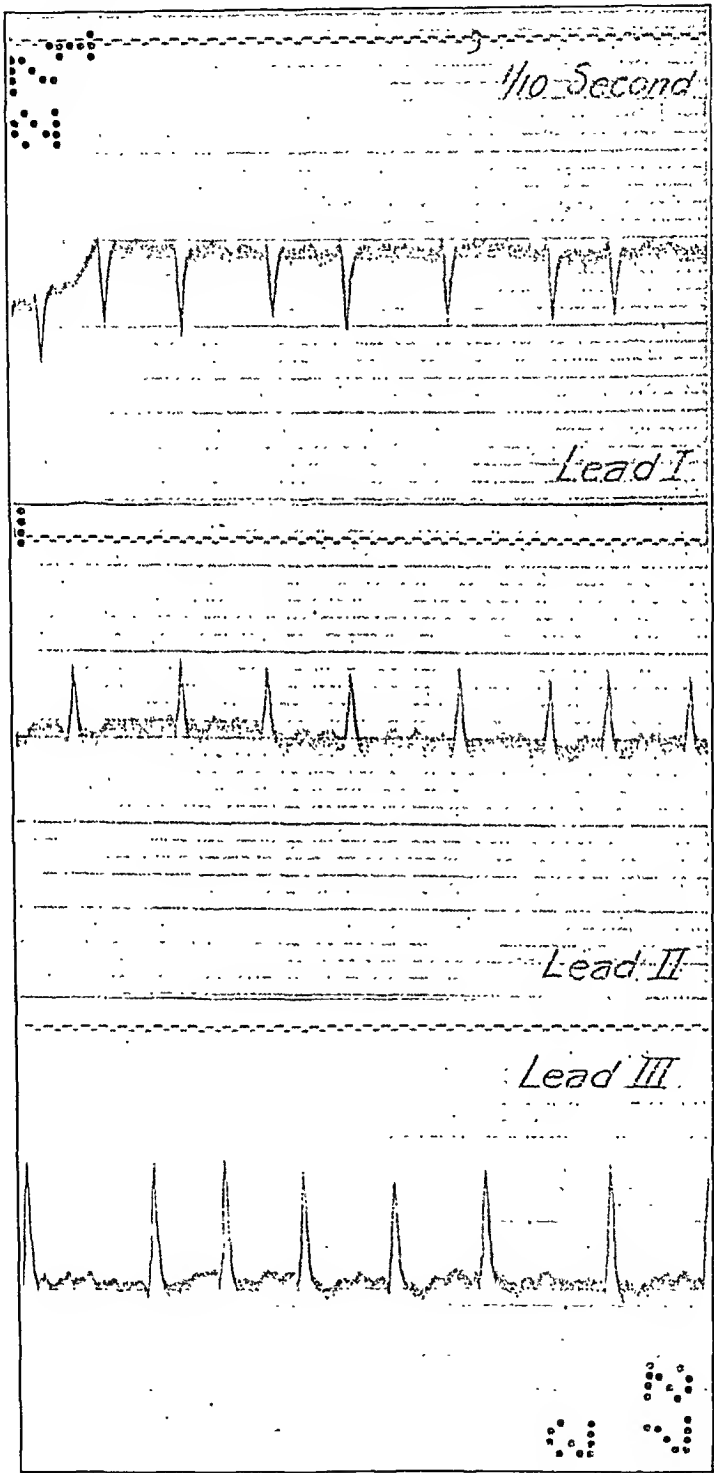


FIG. 1.—Reversal of ΔR I, in hypertrophy of the right ventricle. The heart is completely irregular and waves of auricular fibrillations appear. (See Fig. 9.)

Concerning hypertrophy of the auricle, our knowledge is less definite. It may be assumed to exist in the left auricle in cases of well-marked mitral stenosis with good compensation, and in some

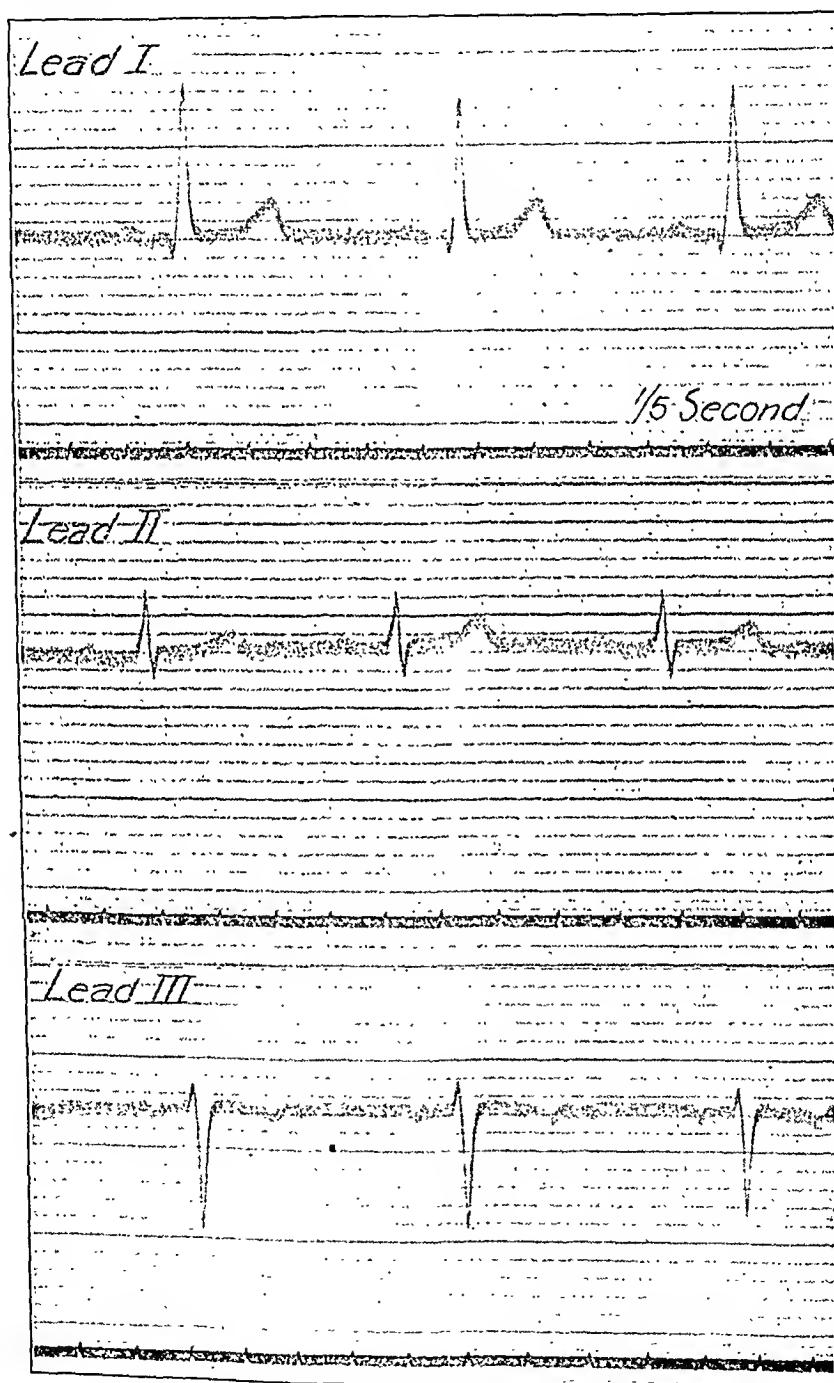


FIG. 2.—Hypertrophy of the left ventricle in mitral insufficiency.

of these cases a decided increase in the magnitude of the wave P has been noted.

In the discussion of hypertrophy we have followed Einthoven's nomenclature, referring to the principal sharp peak as "R," whether directed up or down. Some writers have recently referred to the downward directed wave as "S," but in the absence of exact knowledge of the underlying causes of the change, we feel that the confusion resulting from change in nomenclature is not balanced by any well-defined advantage.

DISTURBANCES OF RHYTHM. Irregularity in the cardiac rhythm has long been familiar as an accompaniment of cardiac disease, and during recent years the study of simultaneous arterial and venous sphygmograms has clearly shown that irregularity may arise in several different ways. Though some of these types of irregularity permit of immediate and easy diagnosis from the sphygmograms, and nearly all of them can be distinguished by close study, their essentially different characters are especially well marked in the electrocardiograms.

Cardiac irregularity may arise as the result of variations in the intensity of vagus innervation. As MacKenzie⁵ has pointed out, this irregularity most frequently takes the form of an occasional slowing of the pulse, often occurring at the time of inspiration, as though it were a reflex increase in vagal innervation. In such cases the electrocardiogram shows only a lengthening of the diastolic interval, the interval between T and P, without other change.

Irregular acceleration of the auricular rhythm has usually been ascribed to the occurrence of auricular extrasystoles. MacKenzie takes this view, and from his definition of an extrasystole as taking origin in some part of the heart other than the sinus region, we presume that he considers the site of origin of these accelerated auricular beats to be always some part of the auricle other than the place of origin of the regular rhythm. While this is unquestionably true in some cases of irregular auricular acceleration, we can see no reason for the assumption that the sinus region itself may not in some cases initiate a premature beat. It is well known that vagal control affects principally the auricles, and if an occasional increase in the strength of vagus tone will cause a delayed beat, it seems reasonable to suppose that the reverse may be true.

Fig. 3 is the electrocardiogram of a patient who has occasional premature beats of auricular origin. Such a premature beat is shown at 1. It will be seen that the P or auricular wave of the electrocardiogram, follows so closely on T of the preceding ventricular phase as partially to merge with it. The ventricular phase corresponding to this premature P is entirely similar in form to those of the normal rhythm. There is a slight lengthening of the

⁵ *The Study of the Pulse*, London and Edinburgh, 1902.

succeeding diastole, but certainly not enough to entitle it to be considered a compensatory pause in the usual acceptance of that term. Furthermore, the radial pulse at the time of these premature beats is as strong and full as at any other time.

This patient presents the clinical evidence of aortic regurgitation, with some mitral stenosis. Compensation is good and there is little evidence of hypertrophy, a clinical finding which is confirmed by the absence of reversal of R III in the electrocardiogram. He has had occasional attacks of tachycardia, usually induced by the swallowing of very cold liquids. The record was taken during a period of comfort, with normal pulse rate. The fact that there is but slight hypertrophy, and the character of the irregularity, seem to indicate that the integrity of the heart muscle is fairly well preserved. It is possible that the attacks of tachycardia in his case

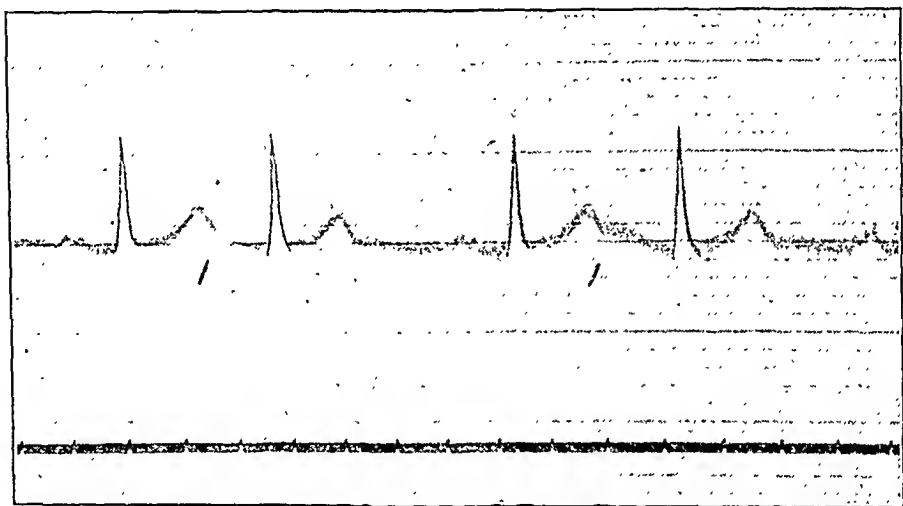


FIG. 3.—Irregularity due to premature auricular (sinus?) contractions.

may have their origin rather in disturbance of the inhibitory or accelerator nervous mechanisms than in an altered condition of the auricle itself.

Fig. 4 is from a young man, aged nineteen years, in whom cardiac irregularity was discovered during a routine examination at his college gymnasium. At (1) it will be seen that a premature beat occurred. Its auricular origin is evidenced by the alteration in form of the preceding T, which is seen to be increased in height, and bifid. The succeeding ventricular cycle presents a little variation from the normal form. It will be noticed that there is an increase of some 4 mm. in the height of R, while T is markedly diminished in height—about 2 mm., as compared with the normal 4 mm.

In this instance an impulse starting in the auricle produces an anomalous contraction of the ventricle. This is difficult to understand in the light of our present conception of the physiology of the

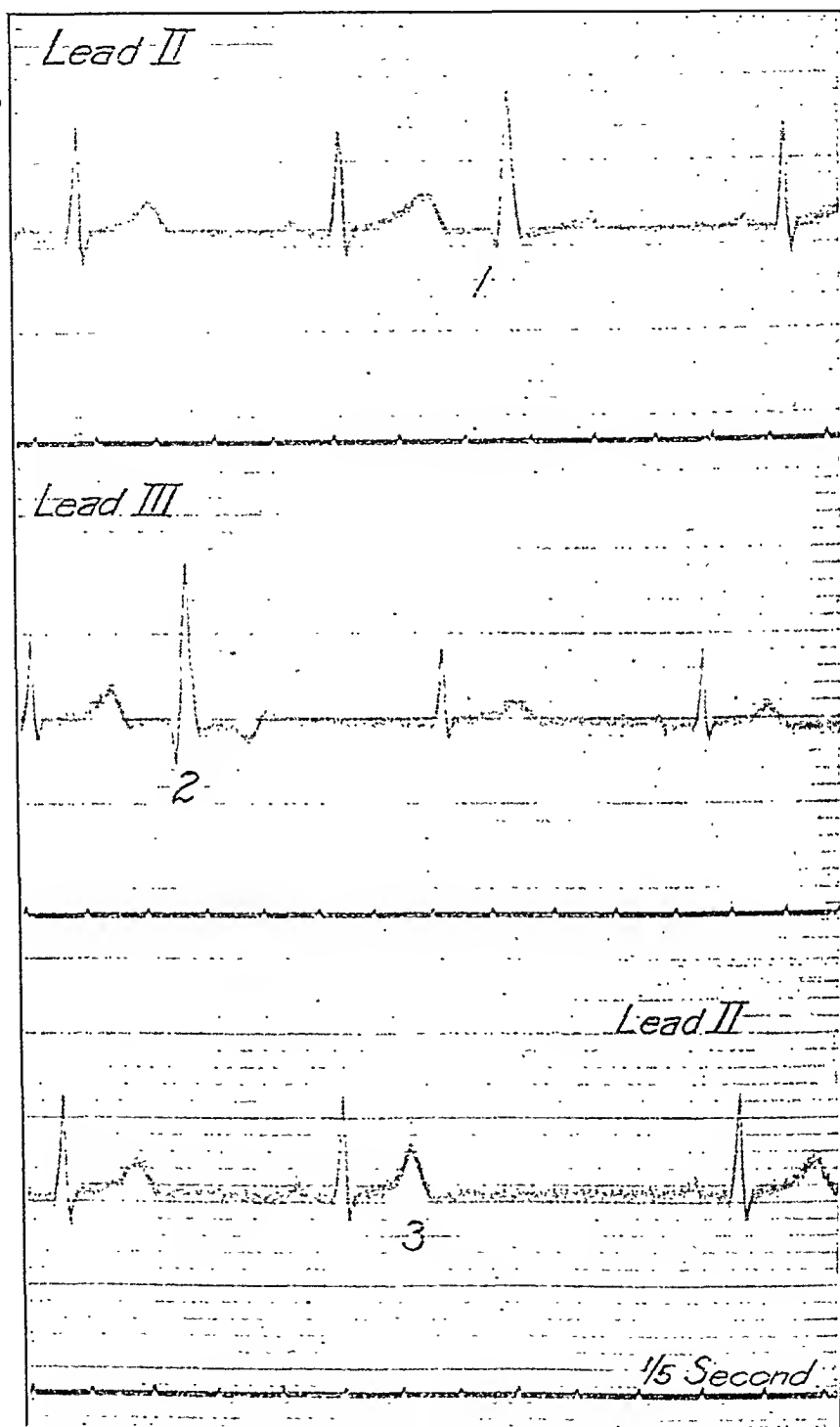


FIG. 4.—Auricular extrasystoles at 1, 2, and 3. The auricular extrasystole at 3 fails to provoke a ventricular response,

auriculoventricular bundle. We have been wont to presume that all impulses reaching the ventricle by way of the bundle would produce therein the same effect, no matter what their origin in the auricle. Evidence is accumulating which tends to indicate that the relations of the bundle to the auricle are less simple than anatomical studies would lead us to presume.

Lewis⁶ has called attention to the fact that the form of the ventricular electrocardiogram evoked by an auricular extrasystole may differ from the form evoked by the normal auricular activity, and further, that in the same subject auricular extrasystoles may evoke more than one anomalous type of ventricular activity. Quite possibly, further study will show that the bundle consists of fiber strands which converge from different parts of the auricle.

At (2), Fig. 4, another auricular extrasystole is shown, followed by a ventricular phase, which departs even more from the normal. At (3) is figured the electrocardiogram of another premature beat. Here the premature beat is indicated only by alterations of the preceding T, and a long pause following. The preceding T is increased fully a millimeter in height, and is not bifid, its top presenting a peculiarly sharp point. Here the premature contraction has occurred so early as to fuse its electrical activity completely with the final phase of the preceding ventricular cycle, and so early as to find the ventricle still in the refractory phase; or, what is much the same, that the conducting paths were refractory as a result of the immediately preceding cycle. The fact that the deformation of the T wave is of the nature of a reinforcement shows that the electrical disturbance caused by the premature auricular contraction was of the same general character as that attending normal beats. In other words, the muscle contraction passed from base toward apex in the auricle.

In Fig. 5 the premature contraction at (1) is distinguished from the normal beats, aside from its prematurity, by the fact that the auricular phase of the electrocardiogram is in the reverse direction from the normal. All the P waves of the regular rhythm are seen to be directed upward, indicating passage of the contraction wave from base toward apex in the auricle. In all the premature beats in this case the P wave is reversed, indicating an origin of the premature beat at a point nearer the ventricles than the site of the normal rhythm.

In this instance there can be no doubt as to the ectopic origin of the early beat, and it is especially interesting to find that in the ventricular response there is a marked departure from the type evoked by auricular impulses of the normal rhythm. It is plainly to be seen that the wave T is of very small magnitude throughout the

⁶ Paroxysmal Tachycardia, the Result of Ectopic Impulse Formation, *Heart*, 1910, i, 262, 282.

normal rhythm, but that the ventricular response to each ectopic auricular beat presents a T wave of much greater height.

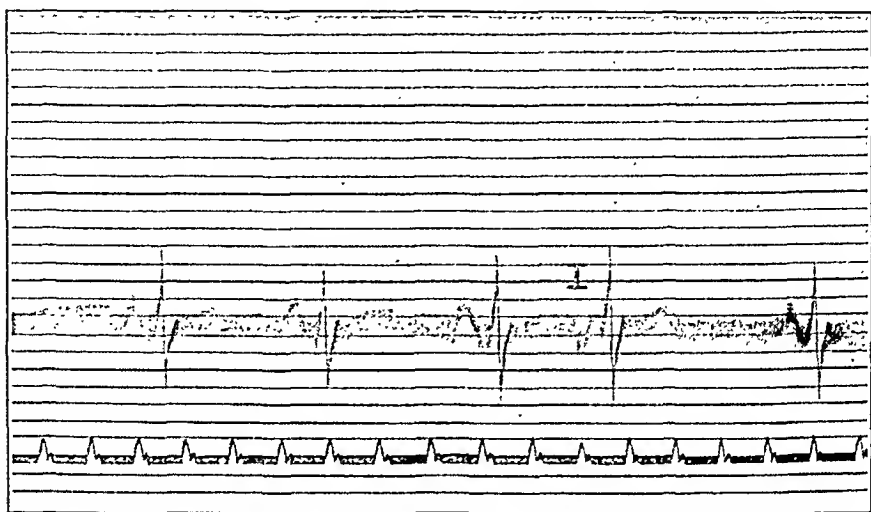


FIG. 5.—Auricular extrasystole (*I*). The reversal of the P-wave indicates that the contraction wave travels in the reverse direction.

EXTRASYSTOLES ORIGINATING IN THE VENTRICLES. Ectopic beats originating in the ventricles give rise to electrical phenomena of various types, according to their place of origin. From anatomical considerations we should expect ectopic beats originating in the auriculoventricular bundle above its division into right and left limbs, to give an electrocardiogram not very different from the ventricular portion of the normal electrocardiogram in the same individual. Since the contraction wave must spread through the ventricular masses in the same manner as a normal contraction wave, it seems reasonable to suppose that the resulting systole will be in every way similar to the normal ventricular systole and attended with a similar electrical complex. In cases of complete heart block, in which the ventricle assumes an independent rhythm, it is found that the ventricular electrocardiogram is of about the same form as the ventricular phase of a normal curve. Records of two such cases have been published by Einthoven.⁷

The tissue of the bundle below the block seems to be the most irritable part of the ventricle, and therefore determines the point of origin of the contraction.

The greater number of ventricular extrasystoles, however, gives rise to an electrical complex entirely different from anything found in the normal electrocardiogram. Einthoven⁸ has referred to these contractions as "atypical contractions." The most striking features

⁷ Le Télécardiogramme, loc. cit., Plate 3.

⁸ Ibid., pp. 151 to 155.

of these atypical electrocardiograms are the abnormally large magnitude of the differences of potential and their close resemblance to the diphasic variation which results when a single muscle wave traverses a piece of skeletal muscle. The form of the atypical curve varies with the lead chosen and with the site of origin of the beat, as may easily be proved by animal experimentation. It is a fairly uniform characteristic of the atypical contractions that the magnitude of the recorded electromotive forces is greater than is the case with normal contractions in the same individual (Fig. 6).

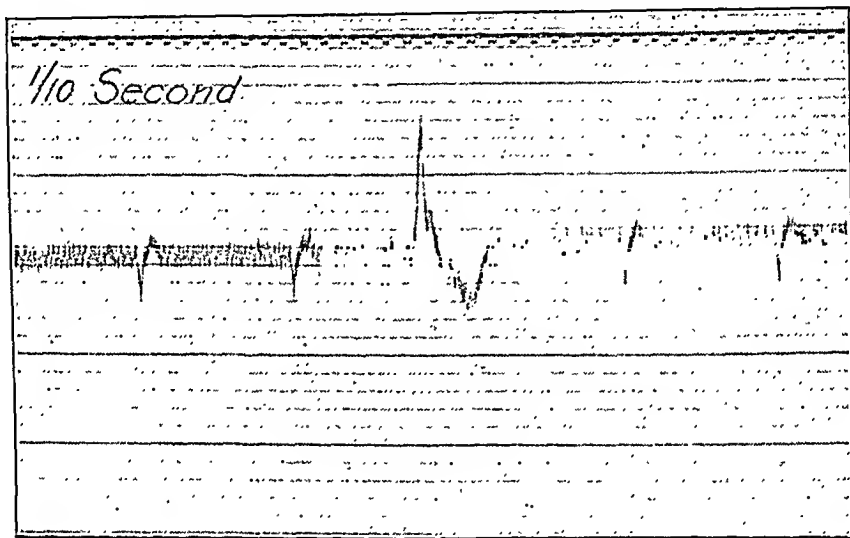


FIG. 6.—Ventricular extrasystole.

In attempting to understand these facts we shall find it helpful to consider the factors which contribute to the formation of the normal electrocardiogram. The anatomical distribution of the bundle suggests, as pointed out by Einthoven,⁹ that the ventricular systole is not simply a contraction wave passing from base to apex, but that the impulse normally reaches many parts of the ventricle at once. We may almost think of the bundle as a sort of primitive motor nervous system connecting auricles with ventricles. The normal ventricular contraction is a coördinated, more or less complicated action. The arrangement of the ventricular muscle fibers is complex, and if we conceive that the normal mechanism of contraction consists in the simultaneous activity of a large part of this musculature, it becomes evident that in different parts of the ventricle muscle waves will be travelling at the same instant, some in one direction, others in another. The electromotive forces resulting from the activity of muscle fibers, in which the direction of propagation of the wave is the same, will be added, while the electrical

⁹ Weiteres über das Elektrokardiogramm, loc. cit., 576.

effect of muscle waves passing in an opposite direction will be subtracted. The total effect at any instant will be the algebraic sum¹⁰ of all the electromotive forces. The maximum electromotive force measured is not necessarily a criterion of the maximum muscular activity. It might conceivably happen that at the time of maximum muscular activity the electromotive forces would nearly balance each other.

To restate the matter briefly, the form of the ventricular electrocardiogram appears to be the expression of the algebraically summed electrical effect of several contraction waves passing simultaneously in various directions through the musculature.

So long as the ventricular systole is initiated through the intermediary action of the bundle, the contraction complex will be constant—except as noted above in the cases of certain auricular extrasystoles.

In the light of these considerations, such a curve as Fig. 6, which is the electrical expression of a ventricular extrasystole, becomes comprehensible. We see that the magnitude of the electromotive forces is much greater than the magnitude of the maximum electromotive force of the normal beats; also, that the curve is a diphasic variation, but with unequal phases. The point of origin of the contraction cannot, in the present state of our knowledge, be stated definitely. It is an experimental fact,¹¹ that extrasystoles evoked by either mechanical or electrical stimulation of points on the surface of the ventricles are attended with an electrical complex similar in its main features to the one figured. The direction of the first phase and the details of the form vary with the exact location of the point stimulated, and with the leads.

We may consider it established with a fair degree of probability that such contractions start either in the muscular mass of the ventricles themselves, or in some of the terminal branches of the bundle tissue. Those who lean to the theory that the initiation of a contraction is a peculiar function of the remains of the primitive cardiac tube will prefer the latter view, though there seems to be no valid reason to exclude the possibility of the initiation of a contraction by any part of the muscle.

At all events, it is evident that the path of propagation of such a contraction wave through the ventricles cannot possibly approximate the normal. From the form of the electrocardiogram it appears that the contraction wave travels over the muscle mass in much the same way as contraction waves pass over portions of skeletal muscle. Instead of a complex coördinated activity of nu-

¹⁰ Kraus and Nicolai, Ueber das Elektrokardiogramm unter normalen und pathologischen Verhältnissen, Berl. klin. Woch., 1907, Nos. 25 and 26; Das Elektrokardiogramm des gesunden und kranken Menschen, Leipzig, 1910, S. 143.

¹¹ Ueber die functionelle Solidarität der beiden Herzhälften, Deut. med. Woch., 1908, No. 1, S. 1.

merous parts of the ventricle simultaneously, we have here a spread of the wave from point to point by contiguity. This view is further supported by the increased magnitude of the electromotive forces, indicative of the fact that there is less neutralization of the electrical effect by simultaneous waves passing in the opposite direction. The fact that the two limbs of the diphasic variation are unequal is doubtless to be referred to the fact that while we are here dealing with a comparatively simple contraction wave spreading from a single point, it is spreading through a complex muscle with the result that the changes in potential of the whole surface of the heart are not quite symmetrical during the early and later stages of the systole.

The well-known fact that an extrasystole of the ventricle is usually almost ineffective in propelling blood has been generally ascribed to the fact that it occurs soon after a normal systole, at a time when the heart is presumed to be nearly empty.

The volume curve of the ventricles, obtained with one of the various forms of cardiometer,¹² shows that ventricular filling begins so soon after the completion of systole as to produce a smooth curve without break, and that the filling occupies about the same length of time as the emptying. Throughout more than half the diastolic period with normal pulse frequency the ventricles are full, except for the insignificant amount which the auricular systole will add. At the time of occurrence of the extrasystoles there must be a very considerable amount of blood in the ventricular cavities.

We desire to suggest the view that the ineffectiveness of such systoles is due not so much to lack of blood to be propelled, or of energy to propel it, as to the fact that the energy is misdirected; the fact, clearly shown by the electrocardiogram, that we are dealing with an incoördinate contraction, a temporary ventricular ataxia. This suggests an explanation of the magnitude of the enormous jugular regurgitant wave which sometimes accompanies extrasystoles in cases of tricuspid insufficiency. Such a case has been described by one of the writers.¹³

It is characteristic of ventricular extrasystoles that they are followed by a compensatory pause of such length that the total duration of the last preceding normal cycle and the extra beat with the succeeding pause is very nearly equal to the time of two normal cycles. This is a consequence of the dependence of the normal rhythm of the ventricles on the auricular rate. The auricular beat following an extrasystole finds the ventricle refractory. The next auricular beat occurs after the usual interval, and the ventricle remains quiescent until it receives another stimulus from the auricle. The nearer

¹² Henderson, *The Volume Curve of the Ventricles of the Mammalian Heart, and the Significance of this Curve in Respect to the Mechanics of the Heart Beat and the Filling of the Ventricles*, *Amer. Jour. Phys.*, 1906, xvi, No. 3.

¹³ James, *A Clinical Study of Some Arrhythmias of the Heart*, *AMER. JOUR. MED. SCI.*, 1908, cxxxvi, 469.

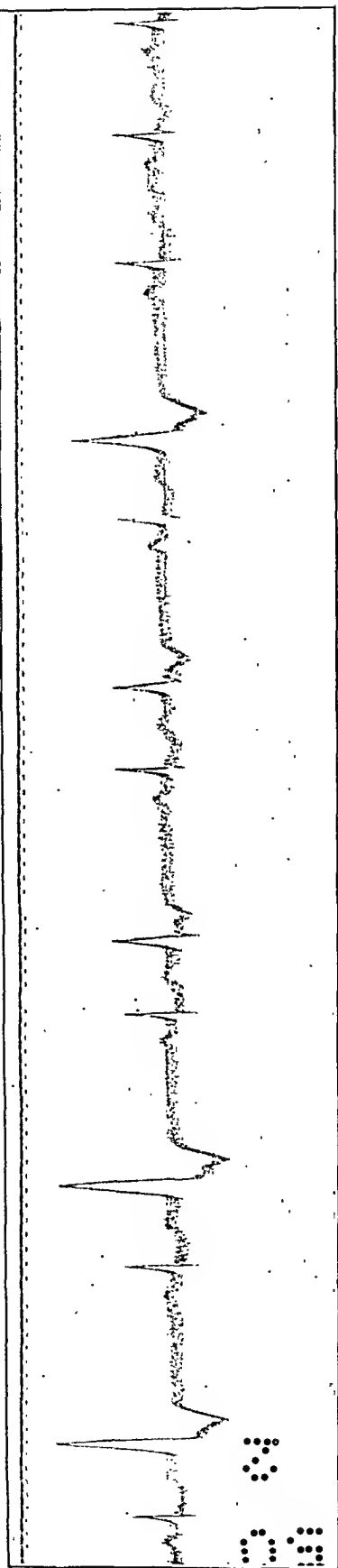


FIG. 7.—Pulsus bigeminus.

the extrasystole occurs to the time of a normal beat, the shorter will be the compensatory pause. If an extrasystole of the ventricle were to occur at the same time as the auricular contraction, the pause following would be longer than a normal diastole by about the length of time which normally elapses between the auricular and the ventricular systole—that is, about one-tenth of a second.

Fig. 7 is from a patient with bigeminal pulse, each alternate beat being a ventricular extrasystole until the last beats of the record, where the normal rhythm was resumed. It will be observed that the first two and fifth extrasystoles have been attended with unusually large differences of potential. From the normal beats at the end of the record it may be seen that the auricular rhythm is not quite regular. If one measures the time between the middle two of these auricular systoles it will be found to coincide exactly with the time which elapsed between each of the very prominent extrasystoles and the last preceding auricular systole.

The electrocardiogram of the fourth extrasystole shown in Fig. 7 presents a small, upward-directed wave interpolated between the two phases of the diphasic curve. The time interval between the last preceding P wave and this small notch is almost exactly the same as that between the first and second P waves of the normal beats at the end of the record. In the case of the extrasystoles which present the extremely large electromotive forces, the thought suggests itself that the auricle has been in contraction at the same time and summed its effect with that of the ventricle.

In the case of the interpolated notch, in the fourth extrasystole, there seems to be considerable reason for presuming that it was caused by auricular activity.

Whether the height of the three large curves was increased by auricular activity occurring at the time of the ventricular contraction seems less clear. The normal P waves have a height of but 2 or 3 mm., while the first curve of the diphasic variation is from 4 to 6 mm. higher than the first curve of the smaller ones. The second, or downward-directed phase of the three large curves, extends 6 mm. below the zero line, while that of the smaller curves extends but 2 or 3 mm. below. This might be accounted for by partial neutralization by simultaneously occurring P waves. The fact that the pauses following the large atypical curves is of about the same duration as that following the smaller ones seems to speak against the supposition that the large curves are due to summation, as does also the fact that the time intervening between the preceding normal beat and the extrasystole is very nearly the same in all cases. Possibly the difference in character of the electrocardiograms of the extrasystoles is merely an expression of the fact that they have arisen from different parts of the ventricle.

THE COMPLETELY IRREGULAR HEART. During the last few years interest in the study of anomalous varieties of heart action has centred on a form of irregularity now familiar to every clinician as a distinct type. This type of arrhythmia has been described under several names, corresponding to a number of theories which have been advanced as to its origin.

Following MacKenzie's hypothesis, the term "nodal rhythm" has been largely applied to it in this country and in England. In Germany, following Hering, it has been designated the *pulsus irregularis perpetuus*, though it has been established that cases occasionally occur in which the arrhythmia is not "perpetual." Other names for the same condition are "completely irregular" and "absolutely irregular" pulse.

The literature of the subject has attained formidable proportions, and only that portion of it will be referred to which is particularly relevant to the present discussion.

The leading characteristic of this complete irregularity, as determined from tracings of the arterial and venous pulses, is the absence from the venous curve of any evidence of auricular contraction, the waves of the venous pulse occurring in synchronism with the ventricular systole.

MacKenzie¹⁴ originally advanced the view that these cases are the result of auricular paralysis, and considered that, in the absence of auricular contraction, the rhythm is set by the ventricles. Subsequently, the finding at autopsy in some of his cases that the auricles were the seat of hypertrophy led him to modify his views and assume a simultaneous contraction of the auricles and ventricles. To

¹⁴ The Inception of the Rhythm of the Heart by the Ventricles as the Cause of Continuous Irregularity, *Brit. Med. Jour.*, 1904, i, 529.

account for such a simultaneous contraction he assumed as the site of origin of the rhythm the tissue situate in the region between auricles and ventricles, and eventually assumed the node of Tawara¹⁵ as the most probable site of origin of a stimulus which he conceived as passing upward to the auricle and downward to the ventricle.

Hewlett¹⁶ and Hering¹⁷ have both called attention to the difficulty of reconciling MacKenzie's view of an infra-auricular origin of the rhythm with the well-known fact that when, in cases of complete heart block, an independent ventricular rhythm is known to exist, this rhythm is not only regular, but very much slower than the rate usually observed in complete irregularity. In the article above referred to, Hering recognizes that the weight of evidence is in favor of a supraventricular origin of the rhythm. He concludes that the particular supraventricular portion of the heart in which the stimulation arises is as impossible to determine as is the cause of the irregularity itself. In a further communication, Hering¹⁸ notes the absence of the auricular (P) wave in the electrocardiogram of complete irregularity. Having convinced himself by animal experimentation that contractions of the auricle, so feeble as to be all but indistinguishable by mechanical means, give, nevertheless, a distinct auricular electrocardiogram, and also that the auricular wave is still to be distinguished from the initial wave of the ventricular electrocardiogram when the two chambers have contracted within one-fiftieth of a second of each other, he is led to the conclusion that in complete irregularity the auricular contraction occurs at exactly the same instant as the ventricular, or else that it fails altogether. In a still more recent paper¹⁹ he commits himself to the view that the theory of complete standstill of the auricle is the one best supported by the evidence. In brief, he refers the origin of the stimulus either to the regions of the mouths of the great veins or the muscle of the auricle, but supposes that the production or transmission of the wave of excitation by the auricle is unattended by contraction of that chamber.

This is a most novel and ingenious conception. That in a condition of depression of the function of contractility the function of conduction or of stimulus production may still be preserved seems theoretically possible. That conduction of a stimulus can take place without giving evidence of an attendant action current in a galvanometer adjusted to the sensitiveness suitable for the recording of the electrocardiogram is evident from the fact that in the

¹⁵ MacKenzie, the Interpretation of the Pulsations in the Jugular Veins, *AMER. JOUR. MED. SCI.*, 1907, cxxxiv, 12 to 34.

¹⁶ The Interpretation of the Positive Venous Pulse, *Jour. Med. Res.*, 1907, xvii, No. 1.

¹⁷ Ueber den Pulsus irregularis perpetuus, *Deut. Archiv f. klin. Med.*, 1908, xciv, 191.

¹⁸ Das Elektrokardiogramm des Irregularis perpetuus, *Deut. Archiv f. klin. Med.*, 1908, xciv, 205.

¹⁹ Ueber das Fehlen der Vorhofzacke beim Irregularis perpetuus, *Münch. med. Woch.*, 1909, xlviii, 2483.

normal electrocardiogram the string remains at rest during the time of passage of the excitation wave through the auriculoventricular bundle. In our estimation, however, the weak point in this theory is its failure to account for the irregularity which is really the crux of the situation. That any single region of the cardiac muscle can develop an irregular rhythm seems very unlikely in the light of our knowledge of the physiology of cardiac muscle. The excised and perfused mammalian heart beats with a perfectly regular rhythm; strips cut from the cold-blooded heart beat regularly, and strips of mammalian heart muscle can be made to contract rhythmically, but always with a regular rhythm. Even skeletal muscle placed in a suitable solution of salts can be made to execute rhythmic contractions, and these are regular.

By exclusion we are forced to seek an explanation along other lines than those thus far indicated.

In January, 1907, Cushny and Edmunds²⁰ reported a case of paroxysmal irregularity of the heart, which inspection of the arterial pulse tracings shows to have been of the completely irregular type during the paroxysms. Having previously observed a very irregular action of the ventricles in animals in which auricular fibrillation occurred during the course of operative procedures, they were led to make a comparative study of the pulse in the two conditions, and offer the suggestion that the condition of their patient may have been due to paroxysms of auricular fibrillation.

Within the last year, Rothberger and Winterberg²¹ have published electrocardiograms obtained from animals during auricular fibrillation experimentally produced. Their electrical records exhibit, in addition to the characteristic irregularity of the rhythm, a peculiar undulatory movement of the string shadow during the diastolic intervals. There is no trace of the normal auricular action current (P). Their electrocardiograms, taken from clinical cases of "Pulsus irregularis perpetuus," present in all respects a most striking resemblance to the experimental curves.

Lewis,²² of London, has published similar experimental and clinical records, and in his clinical cases, by the use of special electrodes applied directly to the chest wall, he has succeeded in obtaining an especially clear record of the diastolic undulations. As long ago as 1906, Einthoven²³ published electrocardiograms from two cases of this type of irregularity, both of which records exhibit the characteristic diastolic undulations and absence of P-waves.

Hering's electrocardiograms also exhibit the undulations, though

²⁰ Paroxysmal Irregularity of the Heart and Auricular Fibrillation, AMER. JOUR. MED. SCI., 1907, cxxxiii, 66.

²¹ Ueber das Elektrokardiogramm bei Flimmern der Vorhöfe, Pflüger's Archiv, 1910, cxxxi, 387; Vorhofflimmern und Arrhythmia perpetua, Wien. klin. Woch., 1909, xvii, No. 24.

²² Auricular Fibrillation and Its Relationship to Clinical Irregularity of the Heart, 1910, i, 306 to 372.

²³ Le Télécadiogramme, loc. cit., p. 145, Fig. 17, and p. 157, Fig. 31.

they are rendered more or less obscure by the superposition of oscillations of a more rapid period, probably due, as he suggests, to tension of skeletal muscles.

The diastolic undulations which replace the P wave in complete irregularity are irregular in rate, but decidedly slow as compared with the action currents of voluntary muscle. The latter, as has been shown by Piper,²⁴ occur at a rate of from 47 to 50 per second, while in our records the undulations of complete irregularity have a frequency of from 7 to 15 per second, so that they can frequently be observed directly during the taking of the record. On account of the proximity of the hospital to electric car lines, we have been unable to eliminate mechanical vibration entirely from our records; but by taking control curves with every record we have convinced ourselves that the period of vibration of the building is always shorter than that of the undulations in question and longer than that of the voluntary muscle action currents. During the last six months we have taken upward of 300 records, and among all these records nothing corresponding to the undulations of complete irregularity has been found in any case from which the irregularity was absent.

Lewis has called attention to the fact that the height of the undulations is often as great as that of a normal P wave. Hering²⁵ reports that he has observed very large differences of potential to result from ventricular fibrillation. Kraus and Nicolai²⁶ have published the electrocardiogram of a dog in agonal ventricular fibrillation.

Fig. 8 is the electrocardiogram of a dog taken during ventricular fibrillation. The maximum excursions are of greater height than were the R waves of the normal electrocardiogram in this animal. The magnitude of the electromotive forces is doubtless to be explained in the same manner as was suggested in the discussion of ventricular extrasystoles.

Rothberger and Winterberg have indicated their belief that the completely irregular pulse is the result of auricular fibrillation. Lewis has definitely stated his belief that such is the case.

The most important arguments in favor of this explanation may be summarized as follows: It accounts for the rapidity of the rhythm by assigning its origin to the auricles. It accounts for the irregularity. Impulses originate from many points in the auricular musculature, and there may be as many rhythms as there are points of origin. Not every impulse will affect the ventricle, but the chance of its securing a regular rhythm from its delirious pacemaker is very slight. Finally, the correspondence between the clinical condition and the experimental seems to be complete in every feature.

²⁴ Ueber den willkürlichen Muskeltetanus, Pflüger's Archiv, 1907, exix, 301; Neue Versuche über den willkürlichen Tetanus der quergestreiften Muskeln, Ztschr. f. Biol., vol. 1, 393 to 420.

²⁵ Loc. cit.

²⁶ Das Elektrokardiogramm des gesunden und kranken Menschen, S. 144.

In the article cited, Hering²⁷ states that while the hypothesis of fibrillation explains the facts in complete irregularity better, he considers his assumption of auricular standstill to be better supported. The objections which he raises have been answered seriatim by Rothberger and Winterberg,²⁸ and we must refer to the original articles for the discussion.

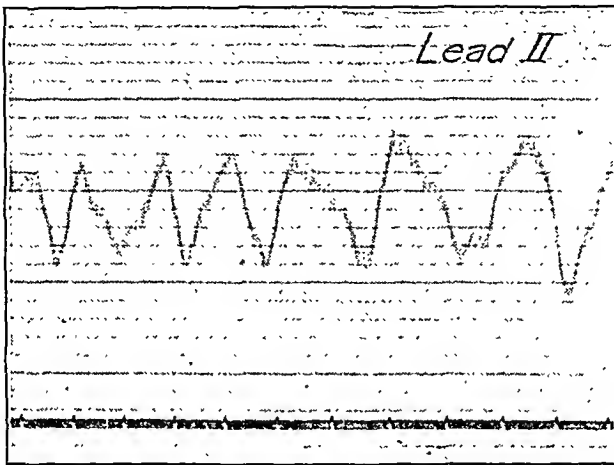


FIG. 8.—Action current of ventricular fibrillation in a dog's heart.

Upon one objection we wish to comment. Hering²⁹ makes the statement that to have the diagnosis of fibrillation in complete irregularity accepted, it must first be proved that the auricles can go on fibrillating for weeks and months, and even for years, as complete irregularity is known to do. He cites Hewlett as having raised the same objection. To this we reply that no evidence is at hand to indicate that fibrillation of the auricles may not persist indefinitely. Once established in the ventricles, fibrillation tends to persist until death, which must shortly ensue through failure of the circulation. Auricular fibrillation is far from crippling the circulation. Blood pressure remains good, and animals may be kept alive for hours with auricles fibrillating. When auricular fibrillation is produced experimentally there is at first a tendency for the auricle to resume the normal rhythm on cessation of the faradic stimulation used to provoke delirium. The oftener the auricle is thrown into fibrillation the longer does the condition persist after cessation of stimulation; at least, that has been our experience. We do not know as yet what underlying factors induce the clinical condition which we believe to be auricular fibrillation, but it seems probable that it will be found to be a degenerative process involving the auricular muscu-

²⁷ Loc. cit.

²⁸ Ueber den Pulsus irregularis perpetuus, Wien, klin. Woch., 1909, No. 51, 1792.

²⁹ Loc. cit.

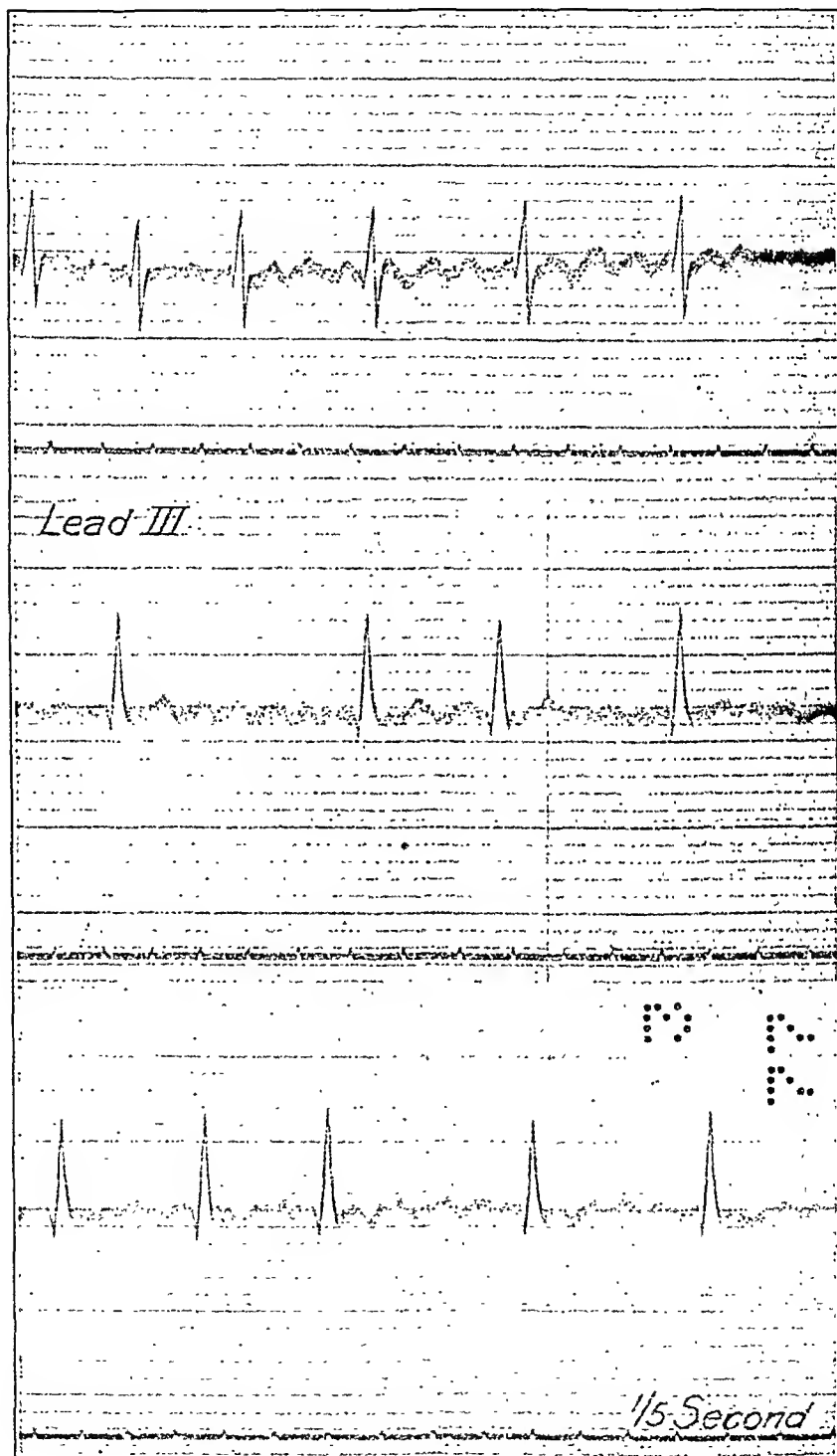


FIG. 9.—Auricular fibrillation in complete irregularity.

lature. At all events, if it be found to be a permanent organic change, there is every reason to suppose that it will tend to perpetuate the condition it has produced. The occasional reversions to the normal rhythm in cases in which the incidence of the complete irregularity has been recent, and the tendency which Hering has noted for this rhythm to become eventually permanent, seem to furnish an additional argument in favor of the fibrillation hypothesis.

Since we have been able to apply the galvanometer to the study of these cases, we have had opportunity to secure records from 16 patients who presented the completely irregular type of pulse. Fig. 9 illustrates typical curves from such cases. It will be seen that there is some variation in the heights of the peaks R and T, and it can be determined that this variation is not conditioned on the respiratory rhythm.

In some cases there is deformation of T, and in some this wave is difficult to distinguish. These characters are to be noticed in the

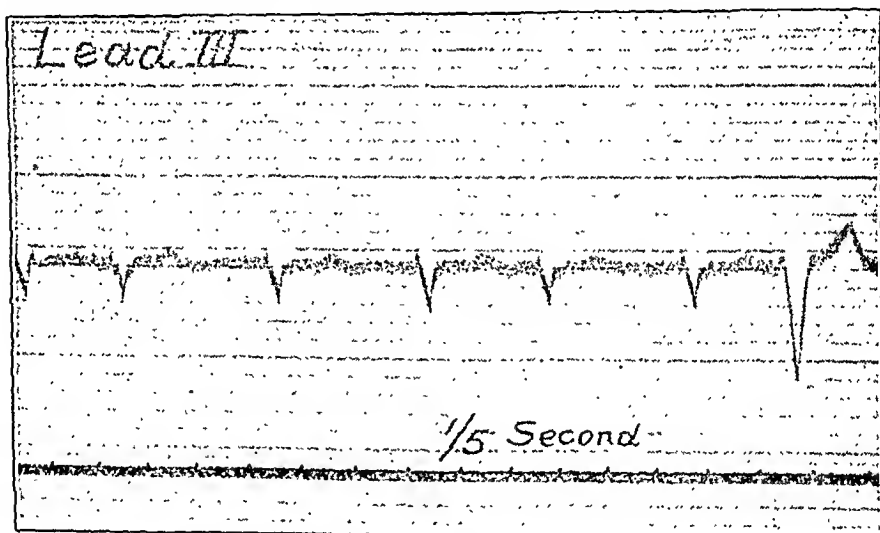


FIG. 10.—Ventricular ectopic beat in complete irregularity.

curves which other observers have published. Lewis ascribes the variations in R and T to reinforcement and interferences between the electromotive forces of the ventricles and the auricles, the latter being in continual activity. Fig. 10 shows, in addition to the usual picture of auricular fibrillation, ectopic beats originating in the ventricle. Lewis has reported a similar case. He refers to the atypical ventricular beat as an "extrasystole." We suggest that, in view of the fact that no regular auricular rhythm exists in these cases, the avoidance of the term "extrasystole" altogether in this connection would tend to greater clearness of thought.

Though there is sometimes great embarrassment of the circulation in cases of complete irregularity, we do not invariably find

great crippling of the circulation associated with this condition. Fig. 11 is an electrocardiogram which presents the characteristic irregularity, and in which the diastolic undulations are especially well marked. For several months prior to the taking of this record the patient's pulse was known to be irregular, and sometimes it has been very rapid—as high as 200 per minute. He has had one attack of dyspnoea. He was perfectly comfortable at the time this record was taken, and at the time of writing he seems, aside from the irregularity of his heart, to be in most excellent health. He has recently been able to enjoy the rather vigorous exercise of an extended fishing trip. The case is of interest on account of the lack of disagreeable symptoms and the almost complete freedom from circulatory disability.

As before mentioned, the underlying cause of the onset of fibrillation is unknown.

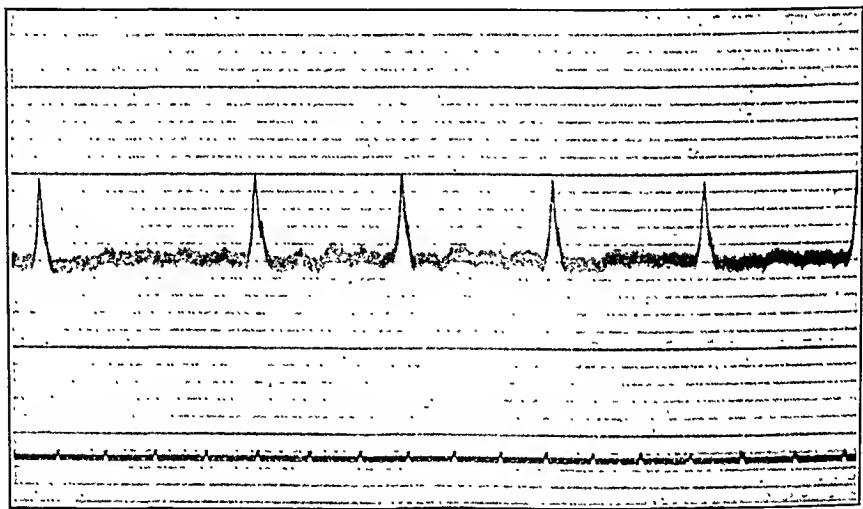


FIG. 11.—Auricular fibrillations in complete irregularity, from a patient in whom the condition produces no disability.

Lewis, in his recent communication, has called attention to the fact that in the greater number of instances in which histological study of the heart in cases of complete irregularity has been undertaken, attention has been directed principally to the condition of the nodes and bundle. It is very much to be desired that in all cases in which complete irregularity has been known to exist, and especially in which it has been possible to secure electrocardiograms, careful histological study should be carried out to ascertain the condition of the entire auricle.

Such a case as the one last described leads one to surmise that the lessened cardiac efficiency observed in many patients with complete irregularity may not be due wholly to the abnormal activity of the

auricle, but that possibly both the auricular fibrillation and the circulatory insufficiency have a common origin in some fundamental anatomical change.

DISTURBANCES OF CONDUCTIVITY. The electrical method is especially well adapted for the study of disturbances of conductivity, on account of the ease with which the auricular and ventricular phases of the electrocardiogram can be distinguished in nearly all of the records.

So far we have had no opportunity to obtain records from a case of complete dissociation.

Fig. 12 is from a patient who was admitted to the hospital with acute cardiac dilatation, and developed a bigeminal pulse after

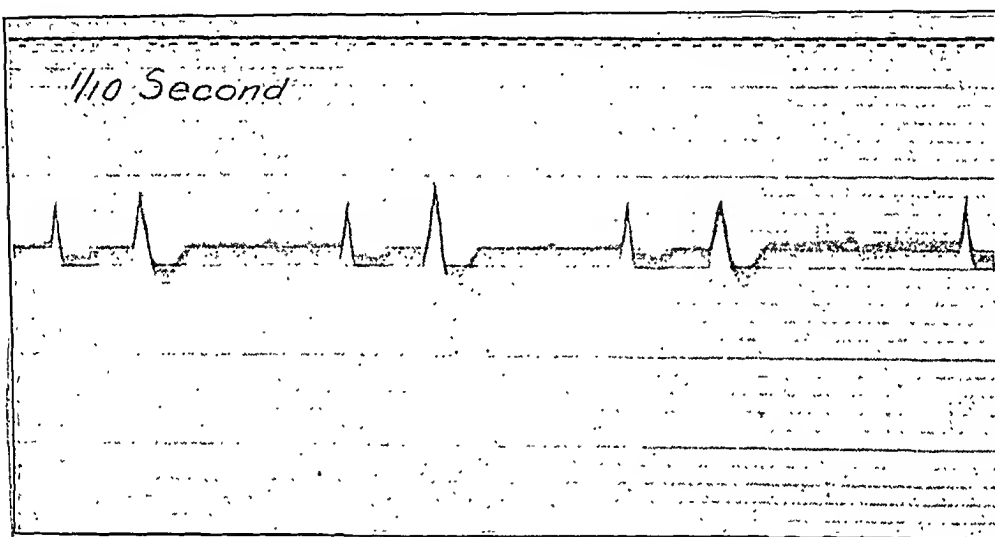


FIG. 12.—Pulsus bigeminus, with disturbed conduction following the administration of digitalis

taking full doses of infusion of digitalis for two days. Aside from the alternation of normal systoles with ventricular extrasystoles, it is noticeable at once that there are very marked variations in the lengths of the P—R intervals, the intervals which represent the time of conduction of the contraction waves from auricle to ventricle.

This effect of digitalis is not uncommon. The patient made a good recovery, and the pulse was normal a few days after this record was taken.

Cases of complete heart block have been reported by Einthoven and others in which the dissociation between auricles and ventricles is clearly distinguishable in the electrocardiograms.

Interesting animal experiments have recently been reported by Eppinger and Rothberger,³⁰ in which they studied the change in the

³⁰ Ueber der Folgen der Durchschneidung der Tawara'schen Schenkel des Reizeitungssystem, Zeitsch. f. klin. Med., lxx.

electrocardiogram produced by section of the right and left limbs of the bundle (limbs of Tawara). They obtained striking effects. The most notable features of the change were an enormous increase in the electromotive forces of the ventricular phase of the electrocardiogram and a change from the normal complex to a diphasic variation, closely resembling the electrocardiogram of a ventricular extrasystole. The sounds changed to a gallop rhythm. For more detailed information reference must be made to the original article.

Fig. 13 is from a patient with moderate hypertrophy. The percussion outlines were: left border, extreme left limit, 6.5 cm. to the left of the midsternal line; right border, 3 cm. to the right of the parasternal line. He has suffered with increasing dyspnoea for the last five years. The second aortic sound is accentuated, there are no murmurs, but there is a gallop rhythm.

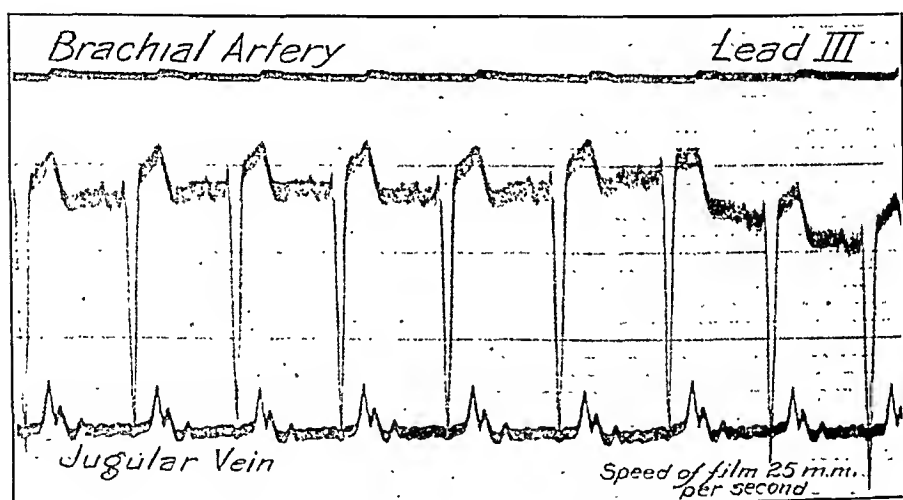


FIG. 13.—Possible lesion of the right limb of the bundle of Tawara.

Fig. 13 is his electrocardiogram obtained with lead III. This record is published on account of the marked similarity between it and the records of the experimental lesions of one limb of the bundle just mentioned.

As Eppinger and Rothberger employed the œsophagus-rectum lead, we have chosen lead III of our case for comparison, as it is in the direction of the long axis of the body and corresponds fairly well with the lead they adopted.

It will be seen that the differences of potential are enormous, and that the ventricular electrocardiogram reminds one strongly of a ventricular extrasystole. Each ventricular electrocardiogram, however, is preceded by a normal P wave. The sensitiveness of the galvanometer in this case was determined before and immediately following the taking of the record, and was, as usual, 1 cm., equal

to 1 millivolt. A downward directed R III, as we have previously mentioned, is uniformly found with left hypertrophy, but this patient presents only a moderate left hypertrophy and considerable right hypertrophy, which, as we have seen, tends to produce an electrocardiogram with strongly upward directed R III.

These several considerations suggest that in this man there is a lesion in the right limb of Tawara. Such a surmise could only be confirmed by postmortem evidence, and we do not wish to have it understood that we feel justified in making a positive diagnosis of this kind at present; but should events prove this diagnosis correct, it indicates one of the ways in which the electrocardiogram may prove helpful in the diagnosis of obscure conditions.

CONCLUSIONS. The large number of inquiries which have reached us regarding the probable future of the string galvanometer as an aid to clinical diagnosis leads us to believe that, in conclusion, a brief consideration of the matter may not be unprofitable.

As an instrument of precision for original study, the string galvanometer leaves little to be desired. The ease with which it may be adjusted to standard sensitiveness, and the rapidity with which the photographic records may be made, presents a striking contrast to the technical difficulties of many physiological methods. Once the apparatus is properly installed, comparatively little skill is required to manipulate it, and this may be readily acquired with practice. In common with all delicate and somewhat complicated physical apparatus, it is liable to occasional derangement, a liability which can be minimized by very careful attention to the original installation. When trouble does occur, it may require a rather intimate knowledge of the physical principles involved to ascertain its nature and make the necessary adjustments.

To those who are interested in the prosecution of original study, and who are able and willing to devote a good deal of time to such work, we can recommend the method as well worth while. It seems probable that its most important field of usefulness, so far as clinical medicine is concerned, will be the clearing up of morbid phenomena now little understood, and that once the explanations have been given, the clinician will no longer need this complicated apparatus to enable him to recognize and understand the conditions it has explained.

Just how much information regarding the effect of treatment in disease of the heart can be obtained by the use of this method cannot as yet be stated, but it seems likely that there is opportunity for fruitful work in that direction. Einthoven has employed the galvanometer in connection with a microphone³¹ as a means of obtaining graphic records of heart sounds and murmurs. So far we have been unable to carry on investigations of this nature except late at night,

³¹ Die Registrierung der menschlichen Herztöne, mittels des Saitengalvanometers, Pfäuger's Archiv, 1907, cxvii, 461.

on account of the noise of traffic in the neighborhood of the hospital. Given a quiet environment, the method is easy of application.

One of the chief merits of the method is that it makes possible the study of cardiac pathology from the functional as well as the anatomical standpoint.

That the galvanometer may prove a great aid in the diagnosis of an occasional obscure case, experience has shown; but considered simply as an aid to diagnosis, its cost and the time requisite to secure the necessary familiarity with its manipulation will preclude its extensive use.

There can be no doubt of the advantage of having the apparatus installed in large medical centres, where it can be used both as a means of diagnosis and for original work as well.

To those who contemplate the use of the apparatus we cannot too strongly recommend that they spare no trouble or expense to have the original installation properly made. While small and comparatively inexpensive models of the string galvanometer are to be had, which serve a useful purpose in special lines of work, they are to be avoided by those who intend to use the instrument for study of the heart. The small instruments with permanent magnets can only be given the requisite sensitiveness by using a very slack string, and this results in a slower movement, similar to that obtained with the capillary electrometer. Curves thus obtained would require mathematical reconstruction to be available. Still more important is the necessity of an optical system with lenses of high aperture, as only by their use can sufficient illumination be secured to insure good photographic results at high rates of film speed. The amount of light which can be utilized depends solely on the optical system, and, as Einthoven has shown, an increase in intensity of the source of light is ineffective after the capacity of the optical system has been reached.

Westerlund³² has called attention to the fact that the small instruments with electromagnets are unserviceable for critical work, because the relatively small masses of metal are rapidly heated by the current used to excite the magnets. The result is that the sensitiveness of the instrument varies from moment to moment.

The matter of insulation is of the highest importance. We emphasize this especially because one recent writer has commented on the fact that he secures satisfactory results without much attention to careful insulation. This may be the case for a long time, but sooner or later, often at the time of a critical observation, the lack of care will be regretted. Einthoven has always insisted on the necessity of careful insulation, and our experience bears out the wisdom of his contention. It may be interesting to know that we

³² Ueber einige Beobachtungen mit einem von Edelmann gelieferten kleinen Modell des Einthoven'schen Saitengalvanometers, Skand. Arch. f. Physiol., 1909, xxii, 281.

suffered the greatest annoyance on a damp day from rhythmic deflections of the string, for which we could account only by the assumption that they were telegraphic code. These signals persisted after disconnecting all wires leading away from the apparatus table, and even after disconnecting one end of the string. We found that our table, painted a dead black with carbon paint, was acting as a large capacity and discharging itself into the string. Proper attention to the insulation promptly corrected the difficulty. The source of the rhythmic variations we assumed to be electric waves from nearby wireless stations. We report this to illustrate a source of trouble which may be easily avoided by proper attention to the installation.

Finally, we have already, in the first part of this communication, urged the advisability of the adoption of uniform methods of work by all who engage in the study of electrocardiograms. The subject at best is beset with difficulty, and if each worker adopts a nomenclature of his own it renders far greater the labor of understanding his communications. Uniformity of nomenclature, uniformity regarding sensitiveness of the instrument, and the taking of all three leads will do much to prevent confusion.

IPECAC IN THE TREATMENT OF INTESTINAL AMOEBIASIS.¹

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THE temporary cessation of dysentery in amoebic infections has been an easy thing to bring about in the majority of cases, but the eradication of the infection was long our despair. The former could generally be accomplished by merely keeping the patient at rest in bed on a suitable diet; in an attempt to accomplish the latter, we treated our patients during four years with copious enemas of normal salt solution, quinine solutions in varying strengths up to 1 to 250, thymol solutions up to a strength of 1 to 500, and quinine and thymol combined in solutions of 1 to 500, and 1 to 1000, respectively. We treated many patients with intestinal amoebiasis both with and without dysentery, and some for prolonged periods of time. Among those with dysentery we never eradicated an infection and amoebæ always reappeared within a few days after treatment was discon-

¹ Read at a meeting of the American Society of Tropical Medicine, St. Louis, June 11, 1910.

tinued, and were present when the patients left the hospital. Among the patients without dysentery we cured the infection of one with 1 to 500 quinine enemas, and of two with enemas of quinine and thymol, 1 to 500 and 1 to 1000 combined.

We have used the bismuth treatment advocated by Deeks and Shaw² without success, but we did not give this treatment a thorough test. However, within a short time following the presentation of the paper by Deeks and Shaw to the Medical Society of the Canal Zone, we admitted to Colon Hospital five patients with recurrences of dysentery, for which they said that they had been treated with bismuth at Ancon Hospital. These patients all had amœbæ in their stools. We cannot feel, therefore, that the conclusions of Deeks and Shaw are justified, and experience has taught us that it is very difficult in Panama to follow one's patients and to make repeated examinations of stools.

IPECAC TREATMENT. On account of the recommendation of English physicians, especially Manson,³ ipecac also was tried, but in an unenthusiastic manner. Without the salol- or keratin-coated pills the doses given were necessarily small, vomiting was frequent, and the ipecac that was retained had no effect upon the amœbæ. We were skeptical about it, as about bismuth, chiefly because of our knowledge of the pathological conditions with which we had to cope, for it was to us inconceivable that any drug given by the mouth could reach the colon in sufficient amount to be parasiticial to amœbæ buried deep in the gut wall or protected in ulcers by a thick layer of tenacious, necrotic material. Local applications and surgical interference held out, to our minds, the greatest hope of success in the treatment of this *bête noir* of tropical and subtropical diseases.

However, after Dock's⁴ communication on the subject, and after one of us had talked with him and with Boggs, of the Johns Hopkins Hospital, who also had used ipecac successfully, we determined to give the drug a thorough trial. We present our cases in detail at the end of the paper. They have been grouped according to the presence or absence of dysentery, according to the length of time that we were able to follow them, and according to the success or failure of the treatment. By "dysentery," we mean the condition manifested by abdominal pain, tenesmus, diarrhœa, and stools containing blood, pus, and mucus.

Eight cases of amœbiasis with dysentery were followed for six weeks to five and one-half months, with repeated examinations of stools for amœbæ. All were successfully treated with ipecac. Case III is the most striking and convincing case that we have had. Three cases (IX, X, and XI) of amœbiasis with dysentery were successfully treated also, but were followed less than six weeks. Three

² Medical Record, November 13, 1910.

⁴ New York Med. Jour., July 10, 1909.

³ Tropical Diseases.

cases (XII, XIII, and XIV) of amœbiasis without dysentery were successfully treated and followed two to five months. In four cases (XV, XVI, XVII, and XVIII) of amœbiasis without dysentery, the ipecac treatment failed. The four unsuccessful cases all belonged to the group of amœbic infections without dysentery; one patient was so susceptible to irritation by ipecac that he could not be thoroughly treated; three were not "bed patients," and the diet was not carefully regulated; none could be considered thoroughly treated. The amœbæ of one of these patients (Case XVI) corresponded to the description of *Entamœba histolytica*;⁵ with Wright's stain the endoplasm took a pale blue stain, the ectoplasm a darker blue, the protoplasm was vacuolated, inclusions were present, the nucleus was ill-defined, and the chromatin scattered; in the fresh specimen the amœbæ were large, active, vacuolated, and the ectoplasm was distinct. The amœbæ of two of the patients (Cases XV and XVII) were small, sluggish, and the ectoplasm was not well defined; the endoplasm stained a deeper blue than that of *Entamœba histolytica*, the ectoplasm a very dark blue, the chromatin was scattered and more abundant, and the nucleus ill-defined. The amœbæ of the fourth patient (Case XVIII) seemed to be *Entamœba histolytica* in the fresh specimen; in the stained specimen, however, they resembled those of Cases XV and XVII, but were much larger.

It is quite probable that different strains of amœbæ will prove to vary in their susceptibility to ipecac. We found this to be the case, apparently, in connection with quinine. The motility of some strains of amœbæ was readily checked by a 1 to 1000 solution of quinine sulphate, and the amœbæ assumed a granular, less refractile, degenerated appearance in from twelve to fifteen minutes. On the other hand, we have experimented with a strain, the amœbæ of which, in fresh stools mixed with quinine so as to make a 1 to 250 solution, retained their motility six to nine minutes; and in 1 to 500 solutions, fifteen minutes. It seems possible, therefore, that a certain number of patients may harbor amœbæ that have the power to resist ipecac, and that a certain number of failures may be expected.

Preparation of Ipecac. Salol-coated pills were used in all the cases except one (Case VI), in which ipecac in capsules was used. Our pills were obtained from one of the reliable drug houses in the United States. The first lot of pills were covered very thinly with salol, and vomiting not infrequently followed, usually three to eight hours after ingestion of the pills. Occasionally, pills were found in the vomitus. In one instance we filtered the vomitus, which had a strong acid reaction, and immersed several of the pills in it. The salol coat was gradually dissolved, and within an hour or two the pills were disintegrated. When Simon's⁶ article, in which he suggested a salol coat $\frac{1}{8}$ inch thick, appeared, we compromised and

⁵ Jour. Infect. Dis., 1908, v, No. 3.

⁶ Jour. Amer. Med. Assoc., 1909, liii, 1526.

ordered pills with a salol coat $\frac{1}{16}$ inch thick. Vomiting has not occurred with these pills, but we have found that they sometimes pass through the alimentary canal before the salol coat is dissolved.⁷ We must be careful, therefore, on the one hand, not to have a coat that is too thin, and, on the other hand, to have it thin enough to be readily dissolved in the intestine. The $\frac{1}{16}$ inch coat of the pills that we have used is certainly thick enough, and perhaps slightly too thick.

The Dosage and Administration of Ipecac. We have tried several systems of dosage and administration. Two patients (Cases III and IX) were given 80 grains to begin with at 9 p.m., and the dose was reduced 5 grains each night until a dose of 10 grains was reached. One patient (Case VI) was treated successfully with ipecac in capsules beginning with only 40 grains. The ipecac was preceded by an opiate. Three patients (Cases I, II, and XII) were given 120 grains during twenty-four hours, and amœbæ were never found afterward, excepting one five months later in Case XII. This is a rapid method, but we do not feel that it is a sure one. It was attempted in Case XVI, and failed, and, moreover, excited a severe dysentery. In Case VIII doses of from 40 to 80 grains were given at intervals of from two to seven days.

We agree with those who advocate beginning with 60 grains, or, better, 80 grains, of ipecac, and reducing the dose gradually until a dose of 10 grains is reached. As a rule, it is unnecessary to continue the treatment longer, and usually advisable not to do so, for the small doses may serve only to keep up a catarrhal condition of the bowel, already excited by the large doses. Such a catarrhal condition with mild diarrhœa seems to be commonly produced.

DIET IN THE TREATMENT. Food plays an important part in the treatment. The pills may be delayed in the stomach by solid food or by milk curds, until the salol coating is corroded and vomiting is excited. We have seen milk curds containing disintegrated ipecac pills vomited several hours after ingestion. One patient (Case XII) took 60 grains at night three hours after eating a light dinner, 40 grains the next morning immediately after a light breakfast of coffee and toast, and 20 grains at noon after luncheon at which some asparagus was eaten. There was no nausea or discomfort until two hours after the luncheon, when an extraordinary pulpy gelatinous mass of asparagus containing disintegrated ipecac pills was vomited. Furthermore, the residue from too much food must certainly serve to embed and scatter the ipecac so that it cannot come into thorough contact with the gut wall. While we believe that many infections may be eradicated without stringent dieting, still in all cases no solid food or milk should be given for

⁷ In the discussion of the paper Simon stated that the salol coat of pills freshly prepared with fused salol was more easily dissolved than the salol coat of the pills that we used. The freshly prepared pills are probably more reliable.

at least six hours before the ipecac, and no food of any kind for three hours before. To insure success, the patient should be kept in bed on liquid diet, milk should not be given during the six hours preceding ipecac, and no other liquids for three hours. We make it a practice to keep the patient lying on his right side because of the possibility that gravity may help the progress of the pills into the pyloric end of the stomach. We have begun now to flush the colon with normal salt solution during the afternoon. The pills are given about 8 or 9 P.M.

SUMMARY. 1. We despaired of success after four years of experience in attempting to eradicate intestinal amœbiasis by means of rest, dieting, and lavage of the colon. We used copious enemas of normal salt solution, quinine, thymol, and quinine and thymol combined.

2. We have apparently cured 14 amœbic infections with ipecac: 8 with dysentery, followed six weeks to five and one-half months with repeated examinations for amœbæ; 3 with dysentery, followed less than six weeks; 3 without dysentery, followed two to five months. We have failed to eradicate the infection in 4 cases, but these were not thoroughly treated.

3. The thickness of the salol coat of the ipecac pills must be carefully regulated so as to prevent vomiting on the one hand, and on the other, the passage of intact pills through the intestinal canal.

4. Probably the best dosage and method of administration is to begin with 60 or 80 grains at bedtime and decrease the dose 5 grains daily until a dose of 10 grains is reached. Rapid cures may sometimes be effected by giving 40 grains three times during twenty-four hours.

4. The patient should be at rest in bed and on liquid diet; no solid food or milk should be given for at least six hours previous to the ipecac, and no liquids for three hours previous. No opiate is necessary.

5. Our experience indicates that a large proportion of amœbic infections can be eradicated by ipecac treatment. It is far superior to any treatment that we have hitherto tested, and it should always be given a thorough trial before surgical treatment is attempted.

REPORT OF CASES.

A. CASES OF INTESTINAL AMOEBIASIS WITH DYSENTERY TREATED SUCCESSFULLY WITH IPECAC AND FOLLOWED SIX WEEKS TO FIVE AND ONE-HALF MONTHS AFTERWARD.

CASE I.—No. 20725, white, American; on the Isthmus six months; admitted November 2, 1909.

History. Dysentery in the Philippines in 1909, lasting six weeks, on account of which the patient was sent home. He recovered

and did not have dysentery again until he came to the Isthmus. About one month ago he began to have diarrhoea, tenesmus, and bloody stools, for which he received bismuth treatment at Ancon Hospital. On admission to Colon Hospital, the patient had estivo-autumnal malarial fever, diarrhoea, tenesmus, and bloody stools. Microscopic examination of the stools showed large, active amœbæ. Copious enemata of normal salt solution were given twice daily for thirteen days, and then enemata of 1 to 1000 quinine solution twice daily for thirteen days. At the end of this time, November 27, amœbæ were still present in the stool, though the dysentery had ceased.

Treatment. On November 29 the patient was given 120 grains of ipecac in three doses of 40 grains each, morning, noon, and night.

Subsequent History. The treatment was followed by a recurrence of malarial fever, November 30, and by a sharp attack of diarrhoea with bloody stools lasting about one week. There was no further intestinal trouble, however. The patient was last seen in May, 1910, more than five months after treatment.

Stool Examination. During the dysenteric attack following ipecac the stools were negative for amœbæ, and none were found on subsequent examinations. Examinations were made December 3 and 13, 1909, January 29, February 7, 12, 17, and 20, March 26, April 7, April 13, 1910.

CASE II.—No. 20994, white, American; on the Isthmus eighteen months; admitted November 17, 1909.

History. Dysentery about eleven months before admission; treated at Santo Tomas Hospital, in Panama, for six or seven weeks; was better for one week, but then the dysentery recurred. Three weeks after discharge from Santo Tomas (eight or nine months before present admission), he entered Ancon Hospital and received bismuth treatment for six weeks. Dysentery has persisted intermittently since discharge from Ancon. Entered Colon Hospital first on September 16, 1909; the diagnosis made was amœbic dysentery; amœbæ were present in the stools; treated until November 14 (nearly two months) with enemata twice daily of normal salt solution, alternating with enemata twice daily of 1 to 1000 quinine solution. Dysentery improved, but amœbæ were still present on discharge. Three days after discharge the patient was readmitted (present admission) to Colon Hospital with dysentery associated with large, active amœbæ.

Treatment. Ipecac in 5 grain salol-coated pills, 120 grains in three doses of 40 grains each, was given November 4, 1909.

Subsequent History. The patient vomited one hour and three hours after the first dose, and three pills were ejected. No further vomiting. A slight diarrhoea for one day followed the ipecac, and then the stools became formed and movements normal.

Stool Examination. The patient was under observation until May, 1910 (five months), and there was no recurrence of dysentery. All stool examinations made after the ipecac treatment were negative for amœbæ. Examinations were made November 26, December 10, 12, 1909, March 22, April 17, April 29, 1910.

CASE III.—No. 21743, white, American; on the Isthmus three and one-half years; admitted January 8, 1910.

History. Dysentery three years ago with abscess of liver; operated on at Ancon Hospital with good recovery. Four attacks of dysentery since: (1) February, 1909, in Ancon Hospital; eight days, treated with bismuth; no irrigations; (2) June, 1909, Colon Hospital, nineteen days, amœbæ found, no diarrhoea, but severe burning sensation in lower abdomen; treated with copious enemata of normal salt solution twice daily; improved; (3) July, 1909, Colon Hospital four months, slight diarrhoea on admission, intense continuous burning sensation in lower abdomen, numerous amœbæ in stools; appendicostomy, July 19; cecum and ascending colon were found to be enormously thickened, purple in color, extensively diseased; irrigations through appendix twice daily for eight weeks with 1 to 4000 and 1 to 3000 quinine solution, then no irrigations for about eight weeks; improvement; (4) January, 1910 (present admission), two months after last discharge, nine to thirty movements daily, tenesmus, blood, mucus, intense pain.

Stool Examination. Mucus, blood, pus, enormous numbers of large, active amœbæ, distinct ectoplasm, vacuolated; many with red blood-corpuscles engulfed; stain with Wright's stain like amœbæ of "Cochin China Dysentery;"⁸ that is, they take a darker blue than *Entamoeba histolytica*, and contain an enormous quantity of chromatin diffusely scattered; no discernible nucleus.

Treatment. Ipecac, 80 grains at 9 P.M., January 9. The dose was decreased 5 grains each night until reduced to 5 grains January 24. Patient vomited twice, six and seven hours after the first dose and twice, four and ten hours after the third dose. The patient was discharged February 6, about one month after admission.

Subsequent History. While in the hospital the number of stools per day decreased to two or three; they were semisolid and contained mucus. By February 20 the stools had become normal. Patient was under observation four and one-half months after treatment.

Examinations for amœbæ were as follows:

January 10. Ipecac begun January 9. Amœbæ found in only one of seven preparations examined.

January 11. A few amœbæ found without difficulty.

January 12. Three preparations examined, many amœba-like bodies found, but no motile ones seen.

⁸ Annales de l'institute Pasteur, March, 1909, t. xxiii, No. 3.

January 14. One motile amœba found in searching four preparations.

January 15. Negative for amœbæ.

January 16. Negative for amœbæ.

January 17. Negative for amœbæ.

January 27. Negative for amœbæ.

January 28. Negative for amœbæ.

February 2. Negative for amœbæ.

February 5. Negative for amœbæ.

February 13. Patient returned for examination (discharged one week ago). He has had four or five movements daily, semisolid stools with mucus, but no blood, pain, or tenesmus. Stool examination: Semisolid, masses of mucus, no blood or pus, no amœbæ. (Four preparations examined.)

February 20. One or two normal formed movements daily, no mucus, no pain. Stool examination: Negative for amœbæ, blood, pus, or mucus.

March 20. Stools formed, normal, one daily. Two stools examined, both negative.

April 24. Stools formed, normal; two preparations negative for amœbæ, blood, pus, mucus.

May 29. Patient in excellent condition, bowels regular, stools normal. No stool obtained for examination.

CASE IV.—No. 21362, colored, Colombian; on the Isthmus three days; admitted December 13, 1909.

History. Dysentery began two months ago; diarrhœa, blood, abdominal pain. During first week in hospital patient had three to five movements a day, some tenesmus, mucus, and blood: Large active amœbæ were found.

Treatment. Ipecac, 40 grains December 15, in one dose; 35 grains December 16; 30 grains December 17; 25 grains December 18.

Subsequent History. No nausea or discomfort after ipecac. One stool a day after December 20. Discharged December 29; has been under observation five and one-half months. No further intestinal trouble.

Stool Examinations. January 3, 1910, large amœba-like bodies, no motility.

February 1. Negative for amœbæ.

March 18. Negative for amœbæ.

April 20. Negative for amœbæ.

May 30. Negative for amœbæ.

CASE V.—No. 21487, white, American; admitted from U. S. S. Prairie, December 23, 1910.

History. Dysentery three years ago in Guam, L. I. Was in hospital fifty-four days; severe attacks of diarrhœa at intervals since then; last attack seven months ago. Present attack began three days ago, severe diarrhœa, fifteen or sixteen movements a

day, griping and tenesmus, no blood. On admission patient had diarrhœa, two to nine movements a day. Microscopic examination showed blood and pus; no amœbæ were found in first three examinations; the fourth examination revealed large active amœbæ.

Treatment. Copious enemas of normal salt solution twice daily for two weeks, then discontinued, and rest and dietetic treatment given for about two weeks. Treatment with ipecac was begun January 24, 9 P.M., 80 grains; January 25, 75 grains; January 26, 70 grains; January 27, 65 grains; January 28, 60 grains.

Subsequent History. Ipecac treatment was followed by diarrhœa, with six to thirteen movements daily for one week, then two to five movements for another week. No blood, some mucus. After the second week there were from one to three or four movements daily; stools were semiformal and at times contained mucus. Patient was under observation until March 19, 1910, about eight weeks after ipecac treatment was begun.

Stool Examinations. All negative for amœbæ, January 25, February 2, 5, 8, 18, 20, 21, March 4, 8, 1910.

CASE VI.—No. 21644, colored, Jamaican; on the Isthmus five years; admitted December 31, 1909.

History. Sick three months with dysentery. On admission patient was having from four to eight movements per day, with tenesmus, blood, and mucus. Microscopic examination showed large, active amœbæ, having the staining characteristics described by Craig⁹ for *Entamoeba histolytica*.

Treatment. Treatment with ipecac in capsules was begun December 31, 1910. The three initial doses were 40 grains given at 8 P.M. on succeeding days, then 30 grains daily for two days, 20 grains daily for two days, 10 grains daily for eleven days. The ipecac was preceded by an opiate.

Subsequent History. No vomiting after ipecac; a mild diarrhœa persisted during the ipecac treatment. After treatment was begun the patient was under observation a little over six weeks.

Stool Examinations. All negative for amœbæ, January 11, 13, 24, 25, February 13, 16, 1910.

CASE VII.—No. 21857, colored, Jamaican; admitted January 17, 1910; on the Isthmus four years.

History. Exploratory laparotomy on previous admission and a peculiar condition of the liver found, thought to be gummatous. Patient admitted this time with œdema of the feet and legs and ascites. He had had pain in his bowels for three weeks with diarrhœa, passing blood and mucus. Two examinations of stools, January 18 and 22, were negative for amœbæ, but positive for blood and pus. The patient was having from three to five movements a day. On February 18, innumerable large, active amœbæ

⁹ Loc. cit.

were found; these were vacuolated with well-defined ectoplasm and stained like *Entamoeba histolytica* with Wright's stain.

Treatment. Ipecac, 40 grains February 19, 20, and 22; 35, 30, and 25 grains February 23, 24, and 25.

Subsequent History. No nausea or vomiting and no increase of diarrhoea during treatment. Diarrhoea reduced from four to six movements daily before, to one to three after treatment. Patient was under observation for nearly two months after ipecac was given.

Stool Examinations. Negative for amoebæ, February 18, March 17 and 25, April 10, 1910.

CASE VIII. No. 22,005, white, Italian; on the Isthmus twenty-seven months; admitted January 26, 1910.

History. Diarrhoea for two weeks with as many as twenty movements a day, great weakness, distress after eating for one year. Hemorrhoids. Examination of stools showed mucus, blood, and innumerable amoebæ, large, active, vacuolated, with well-defined ectoplasm. They stained unlike either *Entamoeba histolytica* or *Entamoeba coli*¹⁰ or the amoebæ of Cochin China dysentery. The amoebæ, on account of their size and their stain affinities, gave one an impression of solidity: they seemed massive. The endoplasm took almost a red stain because of the enormous quantity of chromatin, and the ectoplasm was almost a blue black; the nucleus was well-defined and rich in chromatin (Wright stain).

Treatment. Ipecac, 80 grains on January 27; 40 grains, January 28 and 30, February 6, 11, and 14.

Subsequent History. Vomited several times three to six hours after taking ipecac; had no diarrhoea. Was transferred to the surgical side and operated on for hemorrhoids February 21. Re-admitted March 20, 1910, for another operation on an old ventral hernia. Under observation over two months and had no further dysenteric trouble.

Stool Examinations. January 28, amoebæ present. Examinations negative for amoebæ, January 30, February 9, 16, 17, 18, 20 and 21, March 21.

B. INTESTINAL AMOEBIASIS WITH DYSENTERY TREATED SUCCESSFULLY WITH IPECAC AND FOLLOWED LESS THAN SIX WEEKS.

CASE IX.—No. 21345, white, Scotchman; has lived in Nicaragua; on the Isthmus one day; admitted December 12, 1909.

History. Dysentery two and one-half years ago, with several recurrences of active dysentery since, and diarrhoeal attacks nearly every month. He was treated in Ancon Hospital during one dysenteric attack, was in bed thirteen days, and received large doses of bismuth. He has been in England for eighteen months, and while in Liverpool had dysentery and was treated in a hospital there. The present attack began one week ago on shipboard *en route* from

¹⁰ Craig, loc. cit.

England to Colon. He has been having intense abdominal pain, tenesmus, and diarrhoea, and stools have contained mucus and blood. On admission, the patient was having four to nine movements daily, pain was intense and required morphine, the stools were thin, contained blood, and numerous small mucous masses, which were composed almost entirely of amœbæ closely packed together in the field of the microscope. These amœbæ were large, active, vacuolated, had a well-defined ectoplasm, and contained numerous red blood corpuscles; fourteen corpuscles were included in one amœba. They stained with Wright's stain like amœbæ of Cochin China dysentery. Numerous amœbæ were found December 12, 14, 15, and 17.

Treatment. Ipecac was begun December 18, 8 p.m., 60 grains; December 19, 80 grains; December 20, 60 grains; dose decreased 10 grains each night until a dose of 10 grains was reached.

Subsequent History. Patient vomited a few times six or eight hours after taking the ipecac. The stools decreased in number during the treatment; before discharge, January 8, 1910, only one formed normal stool was passed daily. The patient left January 8, 1910, for Nicaragua, and has not been heard from. He was under observation nineteen days after the first negative stool examination.

Stool Examinations. Two amœbæ found December 20 in five preparations. Stools negative for amœbæ, December 22, 23, 24, 30, 1909, and January 2, 3, 5, 8, 1910.

CASE X.—No. 21356, colored, Bolivian; on the Isthmus two years; admitted December 13, 1909.

History. Sick three months with dysentery. On admission, four to ten movements daily; stools contained mucus and blood and innumerable large, active amœbæ, vacuolated with well-defined ectoplasm and staining with Wright's stain like *Entamoeba histolytica*.

Treatment. Ipecac was begun December 15, 8 a.m., 40 grains; dose decreased 5 grains a day for three days; only four doses given.

Subsequent History. No vomiting; diarrhoea persisted, but stools decreased in number while ipecac was being given; stools then became normal for two weeks; then there was a mild diarrhoea for ten days after patient was given "full diet." He was discharged January 17, 1910, in good condition, with normal stools, one month after ipecac treatment was begun.

Stool Examinations. Negative for amœbæ, December 18, 22, 25, 1909, January 1 and 8, 1910.

CASE XI.—No. 23304, white, American; on the Isthmus five years; admitted April 17, 1910.

History. Onset three days ago with diarrhoea; passed blood two days ago. Never had dysentery before. On admission patient had five to twelve movements daily, with pain and tenesmus; stools contained blood and numerous active amœbæ,

Treatment. Ipecac, April 18, 9 P.M., 60 grains; April 20, 40 grains; April 21, 30 grains; April 23, 20 grains.

Subsequent History. No discomfort from treatment, two to four movements daily when discharged April 27, 1910. Patient was seen May 21, and he was in good condition, and had had no recurrence of intestinal trouble. He was under observation one month after ipecac treatment was begun, but the stool examinations covered only eight days.

Stool Examinations. April 19, a few amœbæ, blood, and pus.
April 20. No amœbæ or blood, some mucus.

April 22. Stool semisolid, negative for amœbæ, blood, and mucus.

April 24. Stool negative for amœbæ, normal.

April 27. Stool negative for amœbæ, normal.

C. CASES OF INTESTINAL AMŒBIASIS WITHOUT DYSENTERY TREATED SUCCESSFULLY WITH IPECAC AND FOLLOWED FOR SIX WEEKS TO FIVE MONTHS.

CASE XII.—White, American; on the Isthmus four years.

History. The patient had been under observation two years, had never had dysentery, but had had occasional mild attacks of diarrhœa, and bowels showed a tendency toward looseness; two to four semisolid movements daily. There had never been blood in the stools, but some mucus, and the patient was frequently troubled with flatulency. Many examinations of stools during two years had always shown the presence of numerous large, active, vacuolated amœbæ with well-defined ectoplasm. They stained with Wright's stain like *Entamœba histolytica*. Rest and dietetic treatment and enemas of normal salt solution, quinine and thymol had no effect upon the amœbæ. They averaged fifteen to twenty per field (B and L, 1 ocular, $\frac{2}{3}$ objective) of the microscope a few days before treatment with ipecac.

Treatment. January 2, 1910, Ipecac, 60 grains, 9 P.M.; January 3, 40 grains, 8 A.M., and 20 grains, 1 P.M.—120 grains during twenty-four hours.

Subsequent History. Patient vomited two hours after the last dose of ipecac, and two or three pills were ejected. The treatment was followed by diarrhœa for two days. There was some tendency toward flatulency and mild diarrhœa for several weeks, but there has been no trouble now for three months. The patient has been under observation for five months since the treatment.

Stool Examinations. Negative, January 4, 10, 18, February 2, 13, April 25. On May 27, after a prolonged search, one amœba was found. This amœba was twelve microns in diameter, was very sluggishly motile, no ectoplasm could be seen, no vacuoles and no engulfed bacteria could be made out. It appeared to be *Entamœba coli*, and was not, we believe, a relic of the former infection. Only one was found.

CASE XIII.—No. 21322, white, American; on the Isthmus twenty months; admitted December 10, 1909.

History. Pain in lower abdomen for two weeks; has been having alternating attacks of diarrhoea and constipation; never passed blood. No diarrhoea or constipation in the hospital. Stool examination showed small amœbæ which could not be definitely classified, no blood.

Treatment. December 21, ipecac in 5 grain salol-coated pills, 80 grains at 8 P.M.

Subsequent History. Stool examinations December 22 and 23, negative for amœbæ. Patient was discharged December 24, but returned for examination January 3, 1910, when numerous amœbæ were found. On January 9, amœbæ were still present, and patient was advised to return to the hospital for more thorough treatment. He did so on January 10 (No. 21755).

Second Treatment. Ipecac was begun January 10, an initial dose of 80 grains being given at 9 P.M. This dose was decreased 5 grains each night for one week until a dose of 50 grains was reached, when the treatment was discontinued.

Subsequent History. Vomiting occurred once, and a mild diarrhoea persisted during the treatment, but quickly cleared up afterward. The patient was last seen May 30, 1910, about four and one-half months after the treatment. He was in excellent health and stools were normal.

Stool Examinations. Negative for amœbæ, January 11, 12, 13, 15, 16, 17, 18, February 6 and 22, April 3, May 30.

CASE XIV.—No. 21529, white, American, on the Isthmus three and one-half months; admitted December 27, 1909.

History. Diarrhoea more or less continuously for nineteen years; at times passed blood; no tenesmus for ten years; has been unable for ten years to void urine without having a bowel movement. Mild diarrhoea in the hospital, no hæmorrhoids, no abdominal tenderness, no tenesmus, no blood in stools, but numerous large, active amœbæ, about five per field (B and L, 1 ocular, $\frac{2}{3}$ objective) of the microscope.

Treatment. Ipecac was begun December 29, 80 grains at 9 P.M. The dose was reduced 5 grains each night subsequently until a dose of 10 grains was reached.

Subsequent History. No nausea or vomiting was caused by ipecac; diarrhoea was increased during the treatment to five or six movements, but subsided when ipecac was discontinued. Patient was discharged January 17, 1910; he was then having one or two movements daily. He was seen last February 27, 1910, and up until that time he had been having three or four stools daily, semi-formed, normal color, no mucus or blood, no tenesmus. He was under observation nearly two months after ipecac treatment was begun.

Stool Examinations. Negative for amœbæ, January 3, 5, 6, 7, 14, 30, February 13 and 27, 1910.

D. INTESTINAL AMŒBIASIS WITHOUT DYSENTERY TREATED UNSUCCESSFULLY WITH IPECAC.

CASE XV.—No. 21336, white, Frenchman; on the Isthmus six years; admitted December 11, 1909.

History. Amœbic dysentery and liver abscess in 1907; operated on at Ancon Hospital with good recovery. No recurrence of dysentery. Stools showed a moderate number of small sluggish amœbæ (7 to 14 microns); ectoplasm fairly well defined; small vacuoles, greenish refractility, no red blood cells engulfed. They stained with Wright's stain a rather dark blue for *Entamoeba histolytica*; the ectoplasm stained more deeply than the endoplasm, the nucleus was ill-defined, and the chromatin scattered.

Treatment. Ipecac in 5 grain salol-coated pills begun December 22, 9 P.M., 80 grains; December 23, 70 grains; December 24, 65 grains; December 26, 60 grains; December 27, 55 grains; December 28, 50 grains.

Subsequent History. The patient vomited several times six to eight hours after taking ipecac and had a mild diarrhœa, which quickly subsided. A second course of ipecac treatment was given, but the patient did not return for examination.

Stool Examination. December 29, 1909, negative for amœbæ. January 2, 1910, negative for amœbæ. January 9, 1910, a few small amœbæ like the ones described above.

CASE XVI.—No. 22721, white, American; on the Isthmus five years; admitted March 14, 1910.

History. Constipation six months, burning sensation in abdomen one month. Loss of weight; no diarrhœa. Stools contained numerous large, active amœbæ that stain like *Entamoeba histolytica*.

Treatment. Ipecac, March 15, 60 grains; March 16, 40 grains.

Subsequent History. Ipecac treatment excited a severe dysentery, and had to be discontinued. Patient discharged March 23, 1910.

Stool Examinations. Negative for amœbæ, March 17, 20, and 23. On April 15, numerous large, active amœbæ were present.

Second Treatment. The patient took three doses of ipecac, 50 grains, on successive nights before readmission to the hospital. A dysentery was excited again, and the amœbæ persisted.

Second Admission. May 9, 1910. Patient returned to the hospital and is still under treatment. Each attempt to give large doses of ipecac excites a dysentery, and not more than twenty grains can be given. The failure of the ipecac treatment in this case seems to be due rather to the idiosyncrasy of the patient than to the ineffectualness of the treatment.¹¹

CASE XVII.—No. 23586, white, American; on the Isthmus five years; admitted May 3, 1910.

History. Amœbic dysentery in Ancon Hospital in 1907, active dysentery for three months. Mild attack of dysentery in 1908,

¹¹ Recovery subsequently followed the use of 20 grains of ipecac daily for a prolonged period.

duration ten days. Treated both times with quinine and thymol irrigations; has been feeling weak, with malaise and indigestion, two months. Tendency to constipation. No diarrhoea. Before admission, patient's stools were examined, and small sluggish amœbæ were found resembling those in Case XV. Ipecac was given, beginning with 40 grains and decreasing 5 grains daily until doses of 10 grains were reached. There was no disturbance from the treatment. The patient then returned for examination and the same kind of amœbæ were still present. He then entered the hospital.

Treatment. Ipecac, May 4, 80 grains; May 6, 60 grains; May 8, 9, and 10, 50 grains each day.

Subsequent History. Some abdominal discomfort and diarrhoea during treatment. The pills were a new lot, with a thicker salol coat, and a few, at least, passed through the alimentary canal without dissolving and were found in the feces. The patient was discharged May 15, 1910.

Stool Examinations. May 7, amœbæ, mucus, stool formed.

May 8. Amœbæ, stool semisolid.

May 9. Amœbæ, stool semisolid.

May 10, 11, 12, and 15. Negative for amœbæ.

May 22. Patient returned for examination. He has been constipated since discharged, has small, hard stools, feels very badly, weak, and easily fatigued, sweats profusely. Stools formed, no blood or mucus, numerous small amœbæ like those found on previous examinations and in Case XV. The patient promises to return for treatment.

CASE XVIII.—No. 23918, white, American; on Isthmus ten months; admitted May 20, 1910.

History. Never had dysentery; present illness began four days ago with diarrhoea. Patient had no diarrhoea in the hospital, and stools were normal in appearance. Microscopically there was no blood or pus, but very numerous large, active, vacuolated amœbæ with well-defined ectoplasm. With Wright's stain the endoplasm took a good blue, darker than the pale blue of *Entamoeba histolytica*, the ectoplasm was deep blue, the nucleus ill-defined, and the chromatin abundant and scattered. They resembled more closely the amœbæ of Cochin China dysentery.

Treatment. Ipecac in 5-grain salol-coated pills, May 22, 60 grains; May 24, 50 grains; dose decreased five grains daily for five days until a dose of 25 grains was reached. The patient was allowed "full diet" during the treatment.

Subsequent History. Patient vomited once during treatment; no diarrhoea; discharged May 30, 1910.

Stool Examinations. May 28, negative for amœbæ.

May 30. Numerous amœbæ like those described above.

THE TREATMENT OF ARTHRITIS DEFORMANS.¹

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AMONG the pathological conditions which most urgently demand careful investigation and earnest consideration by the medical profession today, arthritis deformans occupies a prominent position. It does not exhibit the spectacular clinical possibilities of cancer, it will probably never arouse popular sympathy and command popular and municipal revenues as does tuberculosis, but for capacity to make its victims miserable, helpless, useless, and hopeless, it is unexcelled by any condition with which we come in contact.

Contrary to popular belief, it is not a very uncommon disease, and, also contrary to popular belief, the vastly greater proportion of the misery with which these patients have been obliged to struggle in the past, can be avoided by the utilization of present day knowledge concerning it. In order that this desirable result may be obtained, however, it is necessary that this knowledge be widely disseminated among the general practitioners, who see these cases first, whereby an early diagnosis and the early institution of appropriate treatment may be made to replace the antirheumatic and antigouty therapeusis, which has hitherto worked so much direct and indirect mischief to victims of this disease.

DIAGNOSIS. Although the subject of diagnosis is too large to be treated at all satisfactorily in a paper on therapeusis, yet its importance justifies mentioning a few points which help greatly in differentiating this disease, after it has frankly involved the joints, from others which resemble it more or less closely. Arthritis deformans should be strongly suspected when the following conditions obtain:

1. Whenever a case of joint inflammation presents simultaneous involvement of corresponding joints on both sides of the body.
2. Whenever the maxillary articulation is involved.
3. Whenever the joints of the fingers or toes are involved.
4. Whenever muscular atrophy accompanies the outbreak. Rheumatism will sometimes produce atrophy of the controlling musculature, by compelling disuse of the joint, but this takes place in the later stages of the attack. In arthritis deformans, the atrophy frequently precedes the joint outbreak.
5. Whenever a case is accompanied, or has been preceded, by local sweats, local syncope, or local asphyxia of the parts affected, or of the corresponding parts on the other side of the body when but one side is frankly diseased.

¹ Read at a meeting of the Waterbury Medical Society, Waterbury, Connecticut, June 8, 1910.

6. Whenever trophic or pigmentary changes are apparent in the skin over, or in the neighborhood of, the affected joints, in the clavicular regions, or on the outer aspects of the forearms or lower legs.

7. Whenever a patient gives a history of having had, for some time preceding the outbreak, stiffness or soreness of joints immediately after wakening in the morning, which disappeared after using the joints a little.

8. Whenever a case of "stiff neck" proves resistant to ordinary methods of treatment.

9. Whenever a case of apparently rheumatic joint inflammation resists thorough salicyl medication vigorously for more than a week.

Rheumatism is the disease with which arthritis deformans, in its early stages, is most frequently confounded, and in this connection it is important to remember that active arthritis deformans is frequently ushered in by an acute attack of joint inflammation accompanied by general febrile reaction, which subsides without leaving any apparent traces in the joints, and that an early diagnosis of rheumatism when the disease is really arthritis deformans, and management based upon this diagnosis, are responsible for most of the pitiable spectacles so frequently presented to us by victims of this direful ailment in its later stages.

ETIOLOGY. Four different theories are advocated, today, regarding the causation of arthritis deformans: (1) That it is a pure and simple trophoneurosis; (2) that it is a pathogenic infection; (3) that it is an autotoxemia; and (4) that it is one of the ultimate expressions of depressed cerebrospinal function, which may be precipitated by any sufficiently profound systemic toxemia, infectious, intestinal, or metabolic.

Another hypothesis has been suggested—that the disease is the result of abnormal function of one or more of the ductless glands. While there is much in the clinical history to give color to this view of the matter, it has not as yet been sufficiently worked out to give it a stand demanding serious consideration at the present time.

TREATMENT. It does not come within the scope of this paper to discuss the merits of these various theories, but I have enumerated them for the purpose of calling attention to the fact that the therapeutic indications, as far as combating the disease process, per se, is concerned, are essentially identical for all four: (1) To close possible avenues of infection, such as local suppurative, ulcerative, and catarrhal processes, carious teeth, etc.; (2) to improve the general and local nutritional processes, whereby the physiological resistance of the various tissues and the efficiency of the vital activities in general will be augmented; (3) to accelerate the elimination of katabolic products and toxins which depress the vital activities; and (4) to limit the formation of autotoxins. The treat-

ment of the disease, then, resolves itself into applying those measures which will satisfy the above-mentioned indications in the most effective manner, the relief of pain, and the management of the affected joints.

It should be emphasized, at this point, that good results cannot be attained in the treatment of this disease, unless each case is studied exhaustively and conscientiously by itself. Different patients exhibit wide variations in symptomatology, and strict therapeutic individualization is frequently necessary.

PHYSIOLOGICAL THERAPY. In the active management of the disease, per se, five remedial measures stand preëminent: applications to the general surfaces of the body of dry hot air at from 350° to 400° F., electricity, hydrotherapy, mechanical vibratory stimulation to the spine, and dietary regulation.

Dry Hot Air. The general dry hot air application is the most effective single element in the treatment of the disease, and some early cases will recover under it alone. Its physiological action may be summarized as follows: (1) It produces an immediate and powerful stimulation of the vital physical signs, and (2) a reflex stimulation of the functions of all the organs and tissues of the body, resulting in, first, an amount of reconstructive metabolism, which I believe to be in excess of that derivable from the use of other agents, and second, a degree of elimination of katabolic products and toxins which I believe to be also in excess of that derivable from the use of other agents. Its sphere of action, then, would be preëminently in conditions wherein it is desired to secure an increase in the efficiency of the circulatory, nutritional, and eliminative functions, and arthritis deformans manifestly occupies a prominent place among such conditions.

Before leaving the subject of the body dry hot air application, I wish to specify just what I mean hereby. Many who have used dry hot air for the purpose of relieving the victims of this disease will not bear me out in the statement which I have just made regarding its efficiency, and I believe that the unsatisfactory results are largely due, other conditions being equal, to differences in the method of employment rather than to weakness inherent in the remedy itself.

First, it is not a cabinet bath, heated by an alcohol lamp to 150° or 160° F., and in which the patient is treated sitting on a stool; second, it is not a Turkish bath, with a temperature of 180° or 200° F.; third, it is not an incandescent or arc light bath.

The first and second mentioned procedures are almost always debilitating and pernicious when applied with a moderate degree of frequency to cases of this disease, and in the third the light effects are so prominent as to render it impossible to produce anything approaching a proper degree of purely thermal influence. The body dry hot air application to which I refer is given by means of

a metallic asbestos-lined cylinder, long enough to include the body up to the armpits, and heated by gas, gasoline, or electricity. The treatment intensity should be from 350° to 400° F., and the immediate clinical effects are profound enough to render it necessary for the patient to assume the recumbent position, not only during the immediate application, but for some time afterward.

The heat should be run up rapidly, so as to secure the necessary degree of physiological influence as quickly as possible. As a rule, an increase in the pulse rate to 120 beats per minute or an increase in the mouth temperature of 2° F. over what it was before the treatment indicates that a proper degree of influence has been secured, and from twenty to thirty-five minutes exposure will suffice under ordinary conditions. By this method we secure a profound stimulation of physiological function, whereas, if the patient is treated for long periods with the lower degrees of heat the ultimate result is relaxing, depressing, and pernicious.

Electricity. The next most useful of the physiological agents is electricity, and the several forms of current have distinct and definite spheres of action. The one of greatest utility, because its effects, however applied, are general as well as local, is that derived from the static machine, and the spark and wave current are the most frequently serviceable modalities.

Sparks may be applied over the spine and general muscular areas of the body, for their tonic effect, at any stage of the disease, but, as a rule, they had better not be applied to joints wherein acute symptoms are manifest. When the acute process has subsided, however, and the local phenomena have become confined to soreness and fibrous enlargement, I know of no one measure which will so frequently prove effective in removing both as judiciously applied static sparks. The neuralgias which accompany the disease are also, as a rule, amenable to the static spark.

During the acute stage, the static wave current may be applied to the affected joints, twice daily, by means of sheet tin electrodes moulded to the parts, and it is frequently effective in relieving the pain as well as in producing a marked tonic effect upon the organism at large.

The general application of the high frequency current, two or three times a week in the late afternoon or early evening, by means of the spiral wire cage of d'Arsonval or the auto-condensation couch, is very helpful through its tonic and sedative influences upon metabolism and the nervous system, respectively, and sometimes induces refreshing sleep in patients who are otherwise obstinately wakeful.

The high frequency current applied to diseased joints by means of the glass vacuum electrode is fairly effective in relieving the pain, and has also seemed to me to exercise an appreciable amount of influence in removing local pathological conditions.

The continuous current, in the form of central galvanization, is helpful in improving the patient's general condition, and as a sedative to the nervous system, but I have never been able to secure any local effects with it in this disease that I could not have secured just as well, and usually better, with something else, except in muscular spasm due to nerve irritation; in the torticollis of arthritis deformans, the continuous current in doses of from 5 to 20 milliampères, for fifteen minutes, will sometimes give more satisfaction than anything else.

Hydrotherapy. The effect of the hot and cold douche to the spine, and to joints in which the process is not active, is frequently very gratifying in this disease. The circulatory and nutritional functions are noticeably augmented, and considerable influence upon the local pathological condition is often observable. The water should be applied by means of a hose, and the duration of both hot and cold applications, and the pressure at which it is delivered, must be regulated according to the reactive susceptibility of the individual patient. A marked reaction must be obtained if material curative results are to follow, but it must not be overdone.

Dietary Regulation. Absorption of putrefactive toxins from the intestine is held by some observers to be the dominant etiological factor in this disease, and no one disputes the fact that such absorption is depressing in this or any other condition. The prevention of intestinal putrefaction is, then, desirable, and this can best be accomplished by temporarily excluding from the diet those food-stuffs in which putrefactive bacteria are most active. These are meat, poultry, and fish. When these are excluded, however, care must be taken to see that sufficient protein material is supplied by other foods, and milk, eggs, nuts, and gelatin usually take the place of flesh very satisfactorily as far as the nutritional needs of the body are concerned.

Flesh should always be excluded, at least temporarily, when indican is present in the urine, and it will sometimes prove beneficial to exclude it even if intestinal putrefaction is not demonstrable. Aside from this, however, the diet should be as generous and as nutritious as is compatible with thorough digestion and assimilation.

Sour milk, or buttermilk, gives promise of being helpful in this connection. Lactic and succinic acids tend to inhibit the growth of putrefactive bacteria; hence, the frequently repeated introduction of these substances into the bowel would seem to be a logical procedure. Decided results are easily demonstrable. A pint of sour milk, administered in divided doses during the day, will usually greatly lessen putrefaction in the bowel, even if flesh is not excluded from the diet, and when it is excluded, this quantity of sour milk will practically eliminate putrefaction.

The most effective method of administering this dietary is to limit the patient's food to sour milk and well-browned, buttered toast, for a week, or longer if he will submit to it; but the average patient must be suffering a good deal before he can be persuaded to do this. From one to two quarts of the sour milk per day are required when the diet is thus restricted.

Change of Climate. A temporary or permanent change of climate is frequently productive of a certain amount of benefit in this as in other debilitating diseases, but so much more benefit is usually obtainable by the means I am discussing, without change of climate, and so few of the victims of this disease are so circumstanced as to make a change of climate possible, that this frequently-recommended element in its management may be dismissed without further mention.

DRUGS. Alteratives and Tonics. Medication is unsatisfactory as regards the securing of curative results. No substance has yet been discovered which exhibits a specific curative action as far as the disease, per se, is concerned, but there are a few medicines which appear, in some cases at least, to exhibit considerable influence over the condition. All of them, with the exception of thyroid extract and the salicylates, belong in the tonic and alterative classes, hence, produce their beneficial effect by means of their power to influence general or local metabolism. Prominent among them may be mentioned the iodides, cod-liver oil, the hypophosphites, arsenic in its various combinations, strychnine, and the chloride of gold and sodium.

The iodide of iron has given me the best results. It should be given for periods of six weeks, with an intermission of two or three weeks. Cod-liver oil does good service in cases characterized by emaciation, if well-borne by the stomach. Arsenic and strychnine are fairly useful, in many instances, as general tonics. Chloride of gold and sodium, and sodium or potassium iodide or hydriodic acid sometimes seem to render considerable service, but they fail to influence the disease in such a large proportion of cases that their importance is not nearly so great as is generally supposed.

Thyroid Extract. The beneficial influence which thyroid extract exhibits in some cases of this disease is particularly interesting, because of the possibility that aberrant function of ductless glands may be concerned, to some extent at least, in its etiology. R. Llewellyn Jones, of Bath, England, whose monumental work on arthritis deformans is a veritable mine of information and interest, favors its use in certain cases, especially when the thyroid gland is atrophied, or when the vasomotor phenomena peculiar to the disease are prominent. He also refers to MacAlister, Lancereaux, Revilliod, Midelton, and others as having observed good results from its administration. I have administered it to a few patients and feel that they have derived considerable benefit therefrom.

The remarkable results which have followed its administration in some cases demand that it be thoroughly investigated.

Salicyl Compounds. The relation of the salicylates to this disease deserves special mention, as they sometimes render excellent service in relieving pain and swelling. Although it is improbable that rheumatism is an etiological factor in any considerable number of cases, yet it is not so very rarely that an attack of rheumatism becomes engrafted upon an already existing arthritis deformans, and as the salicylates fail absolutely in so many manifestly uncomplicated cases, it seems reasonable to consider that many of those in which they are useful are instances of such a complication. The fact that beneficial influence is obtainable by their use only up to a certain point, would favor this view. The difficulty of making a positive diagnosis of rheumatic invasion under such circumstances is, in many cases, of course, insuperable. Whatever the explanation, the fact remains that salicyl compounds are sometimes very helpful in relieving the painful joint conditions occurring during the course of arthritis deformans.

Laxatives. Constipation is sometimes present in a degree to demand attention, and the various mineral waters, magnesium sulphate, or the aloin, strychnine, and belladonna mixtures, or compound licorice powder will be found helpful. What particular one should be used must be determined by the tolerance of the individual patient.

A substance which I wish to mention particularly in this connection, is ground agar-agar. Three or four heaping dessert-spoonfuls, moistened with water and covered with cream and sugar, or sliced fruits and cream and sugar, constitute a delicious breakfast dish which is very efficient in producing a daily evacuation.

Digestants and Anti-fermentatives. Digestive disorders can generally be controlled by regulating the diet, but the digestive ferments, carminitives, charcoal, bismuth subnitrate, strychnine, and salol will sometimes have to be called upon to assist in this work.

Alcohol. There is considerable difference of opinion regarding the advisability of allowing alcohol in arthritis deformans. Some writers advocate it, some are indifferent, and some frankly disapprove of it. My experience leads me to disapprove of it as a rule. I have not been able to convince myself that patients got along any better with, than without it, and it has sometimes seemed to make the patient nervous and to aggravate the joint trouble, even when the dosage was small.

Tobacco. Tobacco is not usually well borne by these patients, and to some it is frankly and demonstrably injurious, even in very small quantities. I have observed one case in which even two cigarettes a day would stop progress toward recovery. On discontinuing the tobacco altogether, progress would be resumed. This patient was very fond of smoking, and two or three repetitions

of this experience were needed before he became convinced that it would be necessary for him to abstain. After he recovered he was able to resume the habit in moderation, but if he overdid it for two or three days in succession, stiffness and soreness appeared in his joints; these disappeared again after forty-eight hours abstinence.

GENERAL ROUTINE TREATMENT. In order to get the most out of these various remedial measures, it is necessary that they be applied with intelligent system, and a routine standard is necessary as a point of departure; this can be modified to suit the individual peculiarities of the various types of the disease, and the variations in the patient's condition from week to week. That which has given me the most satisfaction is as follows:

1. Rest in a bed for at least ten hours out of the twenty-four.
2. A diet as generous as can be digested and assimilated by the individual patient, without producing putrefaction or fermentation.
3. From $\frac{1}{30}$ to $\frac{1}{40}$ grain of strychnine sulphate, and 2 or 3 grains of ferrous iodide, three times daily, half an hour before meals; and in emaciated cases from 1 to 4 drams of cod-liver oil, after meals.
4. A dose of some one of the various mineral waters, before breakfast, every two or three days, if constipation is present.
5. A body dry hot air treatment two or three times weekly.
6. Central galvanization once or twice weekly.
7. A general application of mechanical vibratory stimulation two or three times weekly.
8. A static electric application at least once every day, consisting, in acute cases, of the Morton wave current over the affected joints or spine, and in the chronic cases of long, thick sparks to the affected joints one day and the Morton wave current localized over these joints the next. In some cases one of the high frequency currents, applied either locally or generally, may advantageously replace some of these static applications, or be added to them.

9. A hot and cold douche to the spine two or three times weekly. This scheme can be added to or otherwise modified, so that the emphasis of the weekly schedule can be laid upon any measure which may be indicated in a given case.

RELIEF OF PAIN. One of the most troublesome symptoms in severe cases, as regards management, is the constant, harassing pain in the joints and nerve trunks. The majority of these patients have become so habituated to pain that they bear a moderate amount without much complaint, but sometimes severe exacerbations will occur, lasting for hours, days, or weeks, which demand attention. The remedial measures already discussed will, in the course of their application for the condition, per se, eliminate a good deal of it, and as the disease improves, the pain lessens pro-

portionately, but the pain of these exacerbations frequently demands direct and immediate relief.

Physiological Therapy. Among the physiological measures I have already mentioned static, high frequency, faradic, and galvanic electricity as being more or less effective in this condition; to these should be added dry hot air, the electric arc and incandescent lights locally applied, the hot water bag, and hot fomentations. In some cases, an ice-cap or piece of flannel wrung out of cold water wrapped in three or four thicknesses about the joint and covered with oiled silk, will give more relief than anything else.

Bier's Hyperemia. Artificial hyperemia by the constriction method has never given me any help in connection with any phase of this disease that I could not have secured just as well with something else, and I have practically abandoned its use in the treatment of it.

Drugs. Baume analgesique (Bengue), the old familiar chloral, camphor, and aconite mixture, and the tincture of iodine externally, have given me good results in some cases.

If physiological measures and external applications fail, drugs must be resorted to, and by reason of the inefficiency of those permissible, this subject may be dismissed very briefly. Opium, or any of its derivatives, is inadvisable because of the chronic character of the trouble, because this drug loses its influence in a few days unless given in increasing doses, and because of its evil effects on the system at large. I have occasionally given coal-tar derivatives, but they also produce undesirable effects upon the metabolic and circulatory functions when continuously administered in effective doses. I have, however, used salicyl compounds and pyramidon with considerable satisfaction, in many cases. The tinctures of hyoscyamus and gelsemium are sometimes helpful in relieving the pains, in the nerve trunks particularly.

Another fairly frequent cause of pain when the larger joints are involved, is spasm of the controlling musculature, occurring during sleep. As soon as the patient relaxes into sound slumber he is awakened by excruciating pains and finds the affected muscles strongly contracted. This sometimes recurs persistently enough to interfere with the securing of a sufficient amount of sleep. Strontium bromide in 20- or 30-grain doses, repeated hourly until the condition is relieved or until three doses have been taken, will usually give good results, and patients stand its continued administration, according to my experience, considerably better than they do that of the sodium and potassium salts.

A mechanical procedure which frequently proves helpful, consists of bandaging the affected muscles snugly (not tightly enough to interfere with the circulation) when the patient prepares for the night. This will sometime prevent the spasm from occurring at all.

MANAGEMENT OF THE JOINTS. *The Acute Stage.* During the acute stages the joints should be kept at rest. I do not mean such complete rest as would necessitate enclosing the member in a splint, but the patients should be directed not to use the joints to such a degree as to produce much pain. They are sometimes urged to force the joints to functionate, no matter how exquisite the anguish induced, in order to "keep the joints from stiffening." Such advice is pernicious in the extreme. If the conditions in the joint are such that ankylosis is threatening, the irritation produced by the laceration and contusions which follow forced function, will hasten its onset and intensify its degree.

The ankylosis of this disease is divisible into two primary groups: one in which muscular spasm is the predominant factor, and another in which structural joint changes are responsible for the loss of function. These two conditions are present in varying proportions in different cases, and it is sometimes impossible to say at first which one is most active in a given case.

The first named variety is frequently present in acute outbreaks, and disappears as the general disease process improves; if the joint structures have not been extensively altered, restoration of function will ultimately be complete. The only local treatment needed is to keep the joints at rest to eliminate degrees of motion sufficient to cause much pain, and the application to the joint of static sparks and the high frequency current by means of the glass vacuum electrode, the electric arc light, dry hot air, and the hot and cold douche of an intensity and under a pressure suitable to the individual patient.

The Chronic Stage. The second variety consists of a later development of the conditions involved in the first-mentioned, and produces some of the gravest problems presented by the disease. The pathology of arthritis deformans is not well understood as yet, but a study of such autopsical observations as are available, demonstrates that the factors to be reckoned with here are: (1) Fibrous adhesions between the contiguous joint surfaces which have resulted from degeneration of the synovia and cartilage, and overgrowth of periarticular structures, and (2) true bony union where the denuded surfaces of cancellous bone have been brought into contact by absorption of cartilage and the synovia. In the hypertrophic form the interlacking of osteophytes sometimes produces ankylosis.

Treatment of the two last named forms may be dismissed in one sentence: nothing but a cutting operation offers any hope of relief. Fortunately, true bony union and exostotic ankylosis are not very common.

Careful consideration is necessary, however, in the case of fibrous adhesions and periarticular overgrowth. The first procedure which comes into one's mind is the forcible breaking down of the

adhesions. Such manipulation is followed by good results in the ankylosis due to confinement of a joint in a splint, and in that resulting from infectious processes, in many cases. It would seem to be logically indicated in arthritis deformans, but, unfortunately, clinical experience proves that pernicious results usually follow its adoption in this disease. Motion may, indeed, be restored to the joint temporarily, but as time goes on the ankylosis returns, and the last condition of the joint is worse than the first; complete ankylosis eventually takes the place of that which was at first only partial.

Just why this measure does not produce the same permanent and happy results in arthritis deformans as in other apparently more or less analogous pathological conditions, has not yet been satisfactorily cleared up, but a possible explanation is suggested by the contention of Painter, Hoffa, and others, that the histological phenomena presented by the joint changes in arthritis deformans are those of degeneration rather than inflammation, which is to say, that the reparative and absorptive powers of the joint structures are greatly impaired in this disease. This being the case, the debris resulting from forcible breaking down of adhesions could not be properly disposed of, and the traumatism not being susceptible of normal repair might, through the irritation induced, result in the formation of more fibrous tissue and, ultimately, denser adhesions. Indeed, one can easily conceive that areas of bone might be denuded of their cartilage and true bony union be facilitated thereby.

Whatever the explanation, the fact remains that sudden, forcible breaking down of the ankylosis of arthritis deformans, when it exists to any great extent, is very rarely followed by anything but evil and pernicious results, should never, under any circumstances, be attempted while the disease manifests any active tendencies, and only in a cured case after the most careful consideration of the conditions surrounding the individual patient.

After the acute process has subsided, however, judiciously regulated, gradually increased movements of the stiffened joints, both active and passive, are productive of much benefit, and frequently, partial ankylosis can be entirely removed thereby. Neither active nor passive movements should be carried to the point of exciting much pain, and if soreness or stiffness are aggravated, it may be looked upon as an indication that the movements are excessive.

The physiological measures useful in treating the first-mentioned variety of ankylosis are just as useful in connection with the graver form.

RESULTS. *Early Cases.* Under the treatment herein outlined, early cases usually recover promptly. By early cases, I mean those in which structural joint changes have not yet progressed sufficiently to produce ankylosis. If the patient will then take

good care of himself, avoid excessive nerve strain, and so regulate his diet as to eliminate intestinal toxemia for a couple of years, he will ordinarily retain his regained health. An exception to the foregoing statement is to be noted in connection with recurrent cases caused by attacks of la grippe or other infectious processes. These are beyond the patient's control, but recurrences so caused usually respond to treatment as kindly, in some cases even more kindly, than did the original attack.

It is the facility with which these early cases respond to proper treatment that causes early recognition of the disease, whereby the early institution of appropriate management becomes possible, to assume such importance.

Late Cases. In the late cases the prognosis is not good. Persistence in thorough treatment extending over long periods of time, from one to two years, will check the disease process, per se, and stay further destruction of joints in many cases. In a few (a very few) cases complete ankylosis will yield and the restoration to health will be complete. In the great majority of these late cases, however, all that can be attained is relief of pain and a certain amount of improvement in the general condition, whereby the victim's life is rendered more endurable. In a considerable proportion of late cases, treatment is of absolutely no avail and the disease continues its progress unabated.

Statistics. In 1904, I reported a series of 51 cases to the Section on Practice of Medicine of the American Medical Association. The results obtained in this group up to that time may be roughly indicated as follows: 17 per cent. had been free from all manifestations of the disease and pursuing their ordinary avocations in apparently unimpaired general health, for from one to two and a half years; 74 per cent. had been benefited in varying degrees; 9 per cent. had been absolutely uninfluenced by treatment.

Up to the present time I have had under observation 160 cases and the percentages have changed so that they now read as follows: 25 per cent. have been apparently cured; 65 per cent. have been benefited in varying degrees, and 10 per cent. have been entirely uninfluenced by treatment. The increase in the apparently cured cases is attributable to the fact that a greater number of early cases have been treated since the first series was reported.

It is true that 25 per cent. of cures cannot be looked upon as a particularly brilliant showing, but when we consider that out of these 160 cases 40 discontinued treatment prematurely for various reasons, some while they were deriving benefit in varying degrees, and that the vast majority of them were late cases, the conclusion appears to be justified that the prognosis under the later therapeutic methods is not nearly as gloomy as it has been

in the past. The smallness of the percentage of cures, on the other hand, emphasizes forcibly the thought which I wish to impart, that is, that early diagnosis is of the first importance, because the vast majority of early cases respond happily and promptly to appropriate management.

THE LEG AND ARM PHENOMENA IN TETANY.

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IN recent years an increasing interest has been taken in tetany because of the attractive field for research which its etiology and treatment have offered. Although these considerations have overshadowed the study of the clinical features of the disease, that phase of the subject has not been entirely neglected, as is evidenced by the fact that new tests have been developed, notably the leg and arm phenomena. These have been of late the subjects of some discussion in German neurological circles, on account of the desirability of having for diagnostic purposes, in the quiescent or free periods of the disease, reliable and simple tests to supplement the tests of Erb and Trousseau and the less characteristic signs of Chvostek and Hoffmann.

In 1906 I had an opportunity to study a case of postoperative tetany for a long period at the French Hospital, New York. Of particular interest in the case was the constant response of the muscles of the extremities to the arm and leg tests. A complete report of the case was published,¹ yet a brief review of the features bearing on these new phenomena may prove of interest. The patient, a woman, aged thirty-three years, from whom the left lobe of the thyroid had been removed elsewhere several years before, developed the typical symptoms of tetany four days after I performed a partial thyroidectomy, the isthmus and adjoining part of the right lobe being removed, with ligation of the inferior thyroid vessels of the right side. Most of the right lobe was left. Among the significant features of the disease were frequent attacks of symmetrical and bilateral tonic contractions of the hands and feet and the presence of Chvostek's and Trousseau's signs, the latter characterized by slow contractions accompanied and preceded by cramp-like pains. "Contractures also resulted from making the sciatic nerve tense by holding the patient in a sitting position, so that the trunk and thighs were flexed beyond a right angle, with the legs extended; or by putting the nerves of the brachial plexus on the stretch by elevating the arm above the

¹ *Annals of Surgery*, October, 1907.

head with the forearm extended (extreme abduction). The contracted muscles were always board-like to the touch" (p. 510).²

The methods of evoking these contractures in the extremities were shown by illustrations, some of which are well reproduced in Osler's *Modern Medicine*.³ In the leg test the muscles of the calves became markedly contracted; the feet took a position of extreme plantar flexion, with the toes usually turned forcibly toward the sole. In the arm test the abduction must be as extreme as possible, the elbow being held in full extension; the brachial plexus is thus put upon the stretch. The hand took, as a rule, a position similar to that produced by stimulation of the ulnar nerve, with at times flexion of the wrist. The average time from the beginning of the tests to the onset of the contractures was about one and one-half minutes, though this was very inconstant, being sometimes more, sometimes less. It was noted that after about twelve months, while the patient was under treatment, these two tests, coincidently with Chvostek's and Trousseau's, became less marked and finally elicited no response. In a general way, then, it is evident that susceptibility to all of these tests may be simultaneously present; no evidence, however, appears to have been brought out as to the relative reliability and sensitiveness of Trousseau's sign, the most reliable of the older methods, on the one hand, and the arm and leg tests on the other. It was pointed out in the report of the case that "the value of the two tests dependent upon stretching the nerves of the brachial plexus and the sciatic nerve, which were so striking in our case, cannot be estimated until repeated trials have been made in further cases" (p. 527). Consequently, it is gratifying to note that Schlesinger⁴ Alexander, and others have recently independently observed and confirmed the leg phenomenon, which apparently was demonstrated for the first time in my case, in numerous cases of tetany of various kinds. With the exception of Alexander, who has of late independently noted and reported the arm test as present in one case, there seems to have been no further effort to test the arm phenomenon.⁵

If these tests are sufficiently constant in the free interval to be reliable for diagnosis, the ease with which they can be made should

² The passages quoted refer to the original case report.

³ Osler's *Modern Medicine*, vol. vii, pp. 800 and 802, Plates xxxiv and xxxv.

⁴ Ueber ein hischer unbekanntes Symptom bei Tetanie (Beinphänomen), *Wiener klinische Woch.*, 1910, No. 9; Weitere Erfahrungen mit dem Beinphänomen bei Tetanie, *Neurologisches Zentralblatt*, 1910, No. 12; Alexander, Ueber das Beinphänomen bei Tetanie, *Deutsch. med. Woch.*, 1910, No. 22; Pool, Tetany Parathyreopriva, *Annals of Surgery*, New York, October, 1907.

⁵ Ferenczi's experience and conclusions should be mentioned in this connection. As reported in the *Neurologisches Centralblatt*, 1904, vol. xxiii, p. 924, he presented at the Section for Psychiatry and Neurology of the Budapest Medical Society, February 29, 1904, a boy, aged fourteen years, suffering from typical tetany. He noted that contractures occurred on lifting the arm, and interpreted it as Trousseau's sign. He concluded that Trousseau's phenomenon was of vasomotor origin, because in the elevated arm he found the radial pulse only slightly or not at all palpable.

render them of value as an "additional demonstration of the mechanical excitability of the motor nerves by the stretching of the sciatic and the nerves of the brachial plexus" (p. 535). It is in the hope that this communication may cause sufficient interest in the matter to stimulate investigation as to the relative constancy and sensitiveness of these two tests in various forms of tetany that I submit this report.

THE SIGNIFICANCE OF CARDIORESPIRATORY AND SUB-CLAVIAN ARTERY MURMURS.

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MURMURS variously designated as cardiorespiratory, cardiopulmonary, cardiopneumatic, or systolic vesicular have been long recognized. Their causation is obscure and their significance is not fully established. Many of the older clinicians believed them to be commonly associated with pulmonary tuberculosis, but in recent years they have come to be regarded as accidental and as of no particular significance. A review of the standard text-books shows that in some instances there is no mention made of them whatsoever, while in others there is a difference of opinion as to what interpretation should be put on their presence. While some view these murmurs as accidental and of no particular moment, there is considerable support given to the theory that they are most commonly associated with disease of the pleura or lung, especially tuberculosis of the lung.

The commonly accepted theory as to their causation is that during the inspiratory phase the lung is brought into closer relationship with the heart, and as the latter contracts the air in the adjoining pulmonary vesicles is forced out into the bronchi or into an adjacent cavity. While they may be heard with the heart beating but eighty or ninety times to the minute, they are, as a rule, associated with a rapid cardiac action. Sahli states that they depend on variations of the intrathoracic pressure connected with systolic diminution in the size of the heart, which is, we believe, the true explanation, although the exact mechanism is not clear. We incline to this view because transient murmurs having all the characteristics of a cardiorespiratory murmur may be heard in individuals laboring under nervous excitement, with a rapidly acting heart, and

in many healthy young adults after violent exercise. In these individuals the murmur disappears as the heart regains its normal rate.

The cardiorespiratory murmur belongs to that variety of breath-sounds known as "cog-wheel." The murmur is dependent on the movement of the heart, and is heard principally in its neighborhood. It is a short, whiffing, interrupted breath sound, the interruptions being regular and having a rhythm of obvious cardiac origin. Furthermore, it is invariably associated with the systolic phase of the cardiac cycle. It varies in intensity and also in the number of times it is repeated during a particular respiratory act, depending on the rate of the heart and upon the length of the respiratory phase.

The distribution of these murmurs is fairly definite, being, as a rule, in the immediate neighborhood of the heart. They are best heard along the left border of the heart, especially in the second and third interspaces, and in the fifth and sixth interspaces, near the apex, and at the angle of the left scapula. They are less frequently heard along the right border of the heart. They are almost invariably heard during inspiration, but may be heard during expiration or during inspiration and expiration. They may be heard when the individual is breathing quietly, or only on deep inspiration. Posture also seems to influence them, as they may disappear in the recumbent posture, or may be heard only in that position. Furthermore, they do not always remain constant, but may disappear and reappear from time to time at subsequent examinations. They are to be distinguished from endocardial murmurs from the fact that they disappear when the breath is held.

As has been already stated, cardiorespiratory murmurs have been noted as being frequently associated with pulmonary tuberculosis. Lewis¹ has recently recorded 48 cases in which he encountered this murmur. He divided these cases into three groups. In group one, there were 24 cases of undoubted tuberculosis, with strong evidence in favor of pleural involvement. In group two there were 12 cases, in which there was strong evidence of a tuberculous lesion, but in which there were no signs of pleural involvement. In group three, there were 11 cases, with doubtful signs at one or both apices, but in which the history was strongly suggestive of a tuberculous lesion. The only case in which there was no reason to suspect a tuberculous lesion was in a case of double aortic disease.

Lewis also quotes Henssen as having encountered a cardiorespiratory murmur in 39 out of 268 cases; 27 of the 39 had tubercle bacilli in the sputum. In 88 youths in a military school he found the murmur in 4; 2 were suspected of having tuberculosis, while the others gave a history of having had a left-sided pneumonia some years before.

Our results were as follows (Landis): In 228 apparently normal

¹ Quarterly Journal of Medicine, January, 1910.

individuals (95 males, 133 females) a cardiorespiratory murmur was heard in but 2 instances. These cases were examined but once, in the erect posture and during normal respiration and during deep breathing. Of 26 general medical cases (21 males, 5 females) cardiorespiratory murmurs were heard 7 times. In 4 instances the murmur seemed dependent on a tachycardia; 2 of these cases (females) had exophthalmic goitre, while the other 2 (males) had a murmur, apparently due to nervous palpitation, which disappeared as the heart quieted down. In the other 3 the condition present was chronic gastritis, aortic regurgitation, and a convalescent pneumonia in which the left base had been involved. Of 74 tuberculous cases (45 males, 29 females), a cardiorespiratory murmur was present 29 times (23 males, 6 females).

Of 143 cases (Munford), representing a variety of conditions, but for the most part cases of tuberculosis, specifically examined for a cardiorespiratory murmur, the murmur was heard in 32 instances. Of this number, 16 had undoubted tuberculosis. Observations were also made on 1552 men entering the freshman class of Cornell University in the fall of 1909. In the examination of these cases the excitement incident to the ordinary medical case is almost negligible. After auscultation of the heart and lungs, the students were required to, "chin" themselves as often as possible, and then the heart and lungs were again ausculted. In many instances murmurs were then heard which had not been noticed previously. Cardiorespiratory murmurs were heard in 181 instances (11.8 per cent.). In addition to these 181 transient cardiorespiratory murmurs, there were 117 instances of accidental murmurs, apparently endocardial in origin.

The violent exertion incident to the "chinning" also produced in nearly all the cases jerking respiratory movements, usually near the heart, often over the entire left side, and at times over both lungs. Further studies in this direction are necessary, as the sounds produced in the heart and lungs after violent exertion are very confusing and difficult to classify.

Cardiorespiratory murmurs, as already mentioned, may be confined to one particular area or may be heard in two or more of the places of election. The distribution in the 70 cases observed by us was as follows: Near the apex, 29; left border, second and third interspaces, 23; at the angle of the left scapula, 19; along the left border, 19; along the right border, 16; in the axilla, 4; at the angle of the right scapula, 1.

As a rule, these murmurs offer no difficulty in their recognition, and can be readily distinguished from those produced by the heart alone, whether functional or organic, by having the patient hold his breath. In 3 instances a cardiorespiratory murmur was associated with a mitral systolic murmur. In all 3 the cardiorespiratory murmur disappeared when the patient held his breath; and in 1 case it also disappeared when the patient assumed the recumbent posture.

The only murmurs apt to cause confusion are those limited to the pulmonary area. Systolic murmurs in this situation are common in cases of advanced pulmonary tuberculosis, and it is not always easy to say whether they are produced in the pulmonary artery, in the heart itself, or whether they should be classified as cardiorespiratory. If heard in this area alone, they had, in most instances, best be omitted from the latter classification.

Eliminating the instances in which the murmurs were heard as the result of severe exercise, it is significant that they should have occurred in tuberculous cases in 45 out of a total of 70 cases.

The cases studied for cardiorespiratory murmurs, a total of 497 cases, were also examined for the presence of murmurs in the subclavian arteries.

Attention was first directed to murmurs in the subclavian arteries by Stokes, in 1837, his original observation being made in a case with tuberculosis of the left apex. It seems to be the general impression that these murmurs are in some way connected with alterations in the pleura or lung in immediate relation with the artery. This is especially true of the pleura, which may become adherent to the sheath of the artery, and in this way lead to alterations in the caliber of the vessel. As tuberculosis is the most common affection of the lungs, and as the overlying pleura in a chronic tuberculous process is almost always thickened, it naturally follows, if the accepted theory is correct, that these murmurs should be more common in tuberculous individuals.

It must be borne in mind, however, that thickening of the apical pleura is a not uncommon finding, and while often assumed to be tuberculous in origin, this assumption is in many cases not susceptible of proof. There is no doubt that these murmurs are often heard in individuals presumably healthy, and in those who while suffering from illness present no evidence of pulmonary tuberculosis. Palmer (quoted by Walshe) found subclavian murmurs in 102 of 497 healthy workingmen between the ages of sixteen and forty-five years—23 on the right side, 31 on the left side, and 28 on both sides.

Murmurs in the subclavian artery are said to be more common in men than in women, and occur more often on the left side than on the right. The punctum maximum is frequently at the junction of the middle and outer thirds of the clavicle. They are always systolic in time and may be heard either on inspiration or expiration, or both, but are far more often heard during the inspiratory phase. They may be heard constantly or may disappear for a time; in some instances a change of posture from the sitting to the recumbent position will cause their disappearance. Altering the position of the arm is also said to be a factor in their production, while deep breathing makes them louder, and in some instances this procedure is the only way they can be heard. In examining

for these murmurs it is essential that no pressure be exerted on the artery by the stethoscope.

In all there were 31 cases in which a subclavian murmur was heard: Males, 23; females, 8; tuberculous cases, 20; non-tuberculous cases, 11; murmur on the right side only, 8; murmur on the left side only, 14; murmur on both sides, 9; murmur during inspiration only, 23; murmur during expiration only, 6; murmur during both, 2; tuberculous disease of the right apex, 8; tuberculous disease of the left apex, 2; tuberculous disease of both apices, 5.

In 2 cases change of posture influenced the murmur; in 1 the murmur disappeared in the recumbent posture, while in the other the recumbent posture brought the murmur out. In 7 cases a cardiorespiratory murmur was also present.

The murmur did not always occur on the side on which there was obvious disease. In 3 instances a murmur was heard on the right side when tuberculosis of the left apex was present, and in 1 the murmur was present on the left side, with signs indicative of disease of the right apex.

The fact that the murmur is heard more frequently on the left side than on the right side even in those cases in which the disease is more extensive on the right side, suggests that there may possibly be some anatomical variation which would account for the left side being more frequently the site of the murmur.

In conclusion, it may be said that while neither the cardiorespiratory nor the subclavian murmurs are pathognomonic of tuberculosis, it is at least suggestive that they should be so frequently encountered in this disease.

THE PROGNOSIS IN CHRONIC VALVULAR DISEASE OF THE HEART.¹

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I PURPOSE to limit the following discussion to the chronic forms of heart disease, particularly to those exhibiting endocarditis of the valves and to arteriosclerotic changes in the valves and coronary arteries; and to depart from the customary clinical paper by basing it upon personal observation of private cases, and not upon combined hospital and private cases with those culled from the literature and with the added opinions of the masters in medicine. The motive for such a paper is a mixed one. In the first place our

¹ Read at a meeting of the West Branch of the Philadelphia County Medical Society, March 15, 1910.

literature is overweighted with hospital cases and with the statistics based upon them. This does very little harm when we are studying the pathology and diagnosis of disease, but when we wish information about the duration and prognosis of a particular disease hospital cases may be very misleading. As diseases of the heart have been of great interest to me ever since I began the practice of medicine, and as I have been on the staff of the Philadelphia General Hospital for a number of years, the opinion expressed is at least not the result of one-sided observation.

Another motive for treating of private cases only arises from the feeling that every member of our profession should strive to advance our knowledge of medicine; it is a duty which he owes his profession. And it would seem that after practising twenty years even the poorest of us should have learned something which is worth imparting.

AGE. Of the 63 cases studied 40 were fifty years old and over, 28 were over 60 years of age, 16 were over seventy, 7 were over eighty, and 2 were ninety years of age. Two-thirds of the cases, therefore, were fifty years old or more. The impression which is common among laymen that disease of the heart necessarily means sudden death, we have of course long known to be erroneous. But I believe that a great many physicians take much too gloomy a view of the seriousness of disease of the heart. Perhaps we can appreciate the facts better if an attempt is made to estimate the duration of the disease.

DURATION. Of the cases which form the basis of this paper 37, or more than half, are still under observation. Of the remaining number some have died and some have passed from observation, but in very few instances could death have occurred without my knowledge. It has been possible, therefore, to watch a number of the cases for periods of ten years or more, and it is no uncommon experience to see comparatively little change in that time, and often very little abridgement of activity. Some of the patients have had valvular disease for much longer than ten years. In one patient, with aortic insufficiency, the history points to a duration of at least twenty-two years. At that period in the past she was taken to a prominent clinician who made the diagnosis and enjoined her from any exertion which would tax her heart. How long she had the lesion before it was recognized is of course altogether uncertain. But even today it is rather a lesion than a disease; for while she is weak and gets easily tired, she is able to look after her household and family.

In another woman, now fifty-six years old, I have myself been able to keep watch of her progress for nearly twenty years. She had mitral stenosis and some arteriosclerosis at that time. The lesion had probably existed for years before that time. This patient has enjoyed very good health, though she was never regarded

as a vigorous woman. She has survived typhoid fever, appendicitis followed by operation, embolism of the cerebral arteries, and, since this paper was begun, pneumonia of both lungs.

In a woman, now twenty-five years old, I made a diagnosis of mitral insufficiency sixteen years ago. There has been scarcely any inconvenience from the lesion, though she has not quite the endurance she should have, and there is some dyspnoea occasionally following unusual exertion.

In another lady, eighty-eight years of age, there was marked dilatation and hypertrophy of the heart when I began attending her about twelve years ago. It would be a fair estimate to say that the lesion had existed at least as long before I saw her. She has only died since this paper was begun.

In a woman, thirty-five years old, the disease of the heart probably dates back to an exceptionally severe attack of scarlet fever when she was five years old, that is, thirty years ago. She was taken sick in May and was unable to walk until the following September. The lesion is an aortic insufficiency. I have attended her for ten years and she is in better health and has more endurance now than she had ten years ago.

In the great majority of the cases one cannot tell how long the lesion has been in existence. This is partly because our patients come to us with the lesion well established, that is, in many cases it comes on insidiously, and partly because we do not wish to make too direct inquiries about the heart lest we alarm the patient. There can be no doubt that the heart lesion may remain a lesion and not become a disease under favorable circumstances for a much greater number of years than we commonly suppose.

SEX. It has seemed to me that after the stresses of pregnancy and the child-bearing period women bear heart disease better than men. Yet in the series of cases underlying this paper, of the 28 cases over sixty years of age, only 12 were women. The only reason for better tolerance, if they do bear the disease better, is that they are able to lead a more sheltered and protected life. They do not have to go out in all weathers, breast high winds, wade through snow, catch trolley cars, and keep fixed appointments. They are enabled to a much greater extent than men to wait for favorable conditions when they go abroad. But, of course, the men who bear heart disease best are also those who can be shielded from stresses and strains.

Some one may reasonably object that in speaking of the prognosis in old persons with valvular lesions due to atheromatous changes one should really speak of the prognosis of arteriosclerosis. That is true. Nevertheless it is convenient to consider the cardiac lesion as the most obvious local expression of the disease. Moreover, in at least some of the cases, the arteriosclerosis of the valves has an infective process superimposed upon it.

Clifford Allbutt aptly says that the main factors in the prognosis of heart disease are four: The age of the patient, his calling, temperament and habit of body, the specific kind of lesion, and the degree of the lesion.

In the present group of cases it will be remembered that two-thirds of them were fifty years old or more. While it is unlikely that in most of the cases the lesions started in childhood, it is probable that in some of the cases they did. For example, the young woman of twenty-five who has had a cardiac lesion for sixteen years practically without symptoms may reasonably look forward to a considerably longer life with good health. In general, we must admit that in persons past middle life the heart does not accommodate itself to a lesion as well as it does in adolescence. On the other hand, a heart lesion which comes on gradually as part of an atheromatous process is often astonishingly well borne. I have been attending for more than ten years a man who exhibited some enlargement of the heart and mitral insufficiency when I first saw him. The lesion seemed like an old one then. The loud, rough, coarse systolic mitral murmur has scarcely varied during the years I have attended him. While he has had various ailments the heart has called for no treatment and has scarcely ever received any. In other words, there has been a persistent quiescent lesion, but very little disease.

While, therefore, the old heart has less power of adaptation than the young heart, the lack is in part compensated by the lessened stress which sometimes the older heart has to endure. Therefore, if a man during his early life has acquired a competency which enables him to live comfortably without hard work, worry, or much stress of any kind he may, barring accidents, live almost as long with a heart lesion as without it.

Occupation is an important factor in prognosis. One important reason why the prognosis in private cases is so much better than in hospital cases is that among the former there are fewer belonging to the laboring classes. Undoubtedly a man with heart disease is better off doing office work than digging trenches; but we all know that a man doing office work or engaged in professional activity may be so greatly worried and harassed that his heart will suffer.

Habit and temperament are also important factors. A man who eats to excess or who drinks immoderately is more prone to degeneration of the heart and kidneys as well as to accident and acute illness. Moreover, such men are more apt to be sluggish in habit, to be overweight and have flabby muscles. The person who bears chronic heart disease well is he who is of spare build and temperate habit. He does not overwork his metabolic apparatus and has no extra load to carry.

If a man has such a reasonable temperament that his physician can tell him he has heart disease without unduly alarming him, and

the patient will use his knowledge to adapt himself to the altered mode of life which the weakened heart demands much damage may be spared the heart and life be lengthened with maintenance of comfort and usefulness. If, on the other hand, he is nervous and fussy, given to undue haste in his movements, prone to run for a car or to go upstairs two steps at a time, if, in a word, he cannot be schooled into deliberateness of action, he will wear out his heart much sooner.

Another factor in prognosis is the extent of the lesion. The greater the obstruction or the leakage from a valve the greater the strain upon the heart. We have all seen cases of aortic insufficiency for example, in which the jumping arteries, a pronounced water-hammer and capillary pulse, and a marked diastolic murmur all betokened a very decided insufficiency. There can be no question that in such a case the strain upon the left ventricle is far greater than in a case in which the leakage is hard to make out, in which the pulse has scarcely any water-hammer character, and in which there is no capillary pulse. I am not forgetting that the prognosis in all cardiac affections depends more upon the integrity of the muscle than upon the valvular lesion, but only showing how an extensive valvular lesion leads to more damage and strain than a small lesion.

The extent of a mitral lesion may be inferred from the amount of dilatation of the right heart, and the secondary effects upon the lungs, liver, and other organs. A well preserved accentuated pulmonary second sound is of good prognostic import. While in general the character of the murmur is of no aid, it has seemed to me that a long murmur which wholly replaces the first sound indicates considerable regurgitation. When the first sound is well preserved there is either an associated stenosis or there is not very much regurgitation.

THE KIND OF LESION. It is generally conceded that aortic insufficiency is the most serious of the valvular lesions. Mitral obstruction stands next in order of gravity, mitral insufficiency ranks third, and aortic obstruction fourth. Lesions of the tricuspid valve are usually secondary to mitral lesions, in which case the prognosis is that of the primary lesion; whereas, lesions of the pulmonary valve are usually congenital and result in death of the patient either in infancy or by puberty. But aortic insufficiency is less serious when it has followed an endocarditis than when it occurs as the result of arteriosclerosis, chiefly because in the latter form there is greater liability to disease of the coronary arteries, upon the soundness of which depends the integrity of the heart muscle; and also because many patients with aortic lesions have them as the result of syphilis, which causes degeneration of tissues other than the arteries. But the prognosis is good as long as the left ventricle is not much enlarged, and subjective symptoms are absent, and the rhythm is normal. Sudden death from blocking of the coronaries or paralysis

of the ventricles is more apt to occur in this lesion than in any other valvular lesion.

Mitral obstruction developing in early life and serious enough to cause symptoms shortens life, materially hampers its activities, and subjects the patient to dangerous complications. The majority of patients die under forty years of age. Many show poor physical development. I have noticed in girls a later appearance of menstruation and a tendency to irregularity or to amenorrhœa. After marriage some are sterile, and some abort or miscarry in pregnancy, while others die during labor or soon afterward. I am speaking now not of slight lesions but of those developing in early life and serious enough to produce symptoms. Moreover, these patients form the bulk of those showing embolic phenomena of the brain or lungs, and usually die very rapidly if pneumonia sets in.

When the lesion is a slight one it often causes practically no symptoms. The patient learns to adjust himself to a lessened range of activity, and in other respects seems perfectly well.

In advanced cases a persistent arrhythmia may develop. It is of serious import in proportion to its constancy. There is probably involvement of the bundle of His.

Of mitral insufficiency one need only say that slight grades of it are very common and that they do not much impair the activity of the patient or shorten his life. The serious grades bring all the well-known symptoms of broken compensation in their train and greatly shorten life.

ETIOLOGY. In the cases which form the basis of this study it has not been possible to ascertain the cause in most of them. A definite rheumatic history is the exception. To accept the vague leg ache, backache, and tonsillitis as satisfactory evidence of rheumatic fever is unscientific. Undoubtedly rheumatic fever is a very frequent cause of endocarditis and pericarditis, but until we know the causative agent we are likely to attribute many cases to rheumatism which the more accurate knowledge of the future will show were due to other infections. I have seen cases in which there was a distinct history of tonsillitis followed by endocarditis. And I have recently seen an endocarditis follow an ordinary cold with laryngitis. In many of the cases which are found in persons past middle life the endocarditis is only a part of the process which is making progressive changes in the arteries. These cardio-arterial cases form the bulk of the cases which show heart lesions in old persons. In many of them, most of them, I believe, there is also degeneration of the kidneys in spite of the fact that we may not be able to find proof of this in the urine.

As the cause in so many of my cases is uncertain it will be impossible to draw any inference in prognosis based upon the etiology.

In distinctly rheumatic cases the prognosis must often be guarded owing to their liability to a fresh rheumatic endocarditis. The

prognosis improves somewhat with the age of the patients. Young children are very prone to it, older persons much less so. The liability of every damaged valve to a septic endocarditis must also be kept in mind.

IMPORTANCE OF SUBJECTIVE SYMPTOMS IN THE PROGNOSIS OF HEART DISEASE. The tendency in modern times has been to pay more and more attention to physical methods of studying heart lesions. Physical diagnosis has been an attractive study for many of us and we believe that accuracy in diagnosis is more nearly possible now than it was formerly. But physical methods are more valuable in diagnosis than in prognosis. They are a better guide to the lesion than to an estimate of the functional power of the heart. In prognosis we do not so much need to know whether there is a heart lesion as we do whether or not the patient has heart disease. This distinction is all important for prognosis and for treatment; and in making it we should rely upon the presence or absence of subjective symptoms of heart weakness. If a man is able to perform the ordinary duties of his daily life without causing pain or any uneasy feelings referable to his heart, without causing dyspnoea, vertigo, dizziness, faintness, fluttering, irregular action, palpitation or swelling of the feet—such a man may have a heart lesion but he has not heart disease, and as long as subjective symptoms remain in abeyance the prognosis is good. Let us try to estimate the value of the subjective symptoms.

DYSPNOEA. Dyspnoea is so common that it might almost be said to be a constant symptom of cardiac weakness. It occurs in all varieties of lesions, but is more frequent in mitral than in aortic valve lesions, and is evidence of some weakness of the cardiac muscle. It may occur following some acute strain such as athletes sustain, or such as happens at times to mountain climbers, or to women in the late stages of pregnancy or in labor. In these cases there is usually some acute dilatation. If the ventricle is fairly sound the dilatation under rest quickly subsides and the dyspnoea with it. Dyspnoea in valvular lesions also is the consequence of dilatation of the heart or degeneration of its fiber, the latter often preceding and accounting for the former. We find dyspnoea also nearly constant in fibroid heart and in fatty heart, while sometimes with a certain weight or oppression in the chest it is the dominant symptom in angina pectoris.

How shall we estimate the gravity of the symptom in a particular case? By its frequency or constancy, and by the effort which is necessary to its production. Some patients are always short of breath, and upon the least effort it is greatly aggravated. I have seen patients so short of breath that the effect of being fed made them pant for breath, and urination and defecation almost made them faint. Between this extreme degree of dyspnoea and that induced only by running or hastily climbing several flights of stairs,

there are all grades. A very important question to put to a cardiopath, therefore is, how much can you do without getting out of breath? The prognosis will be grave in proportion to the ease with which dyspnoea is induced, its intensity and constancy, and its cause. The prognosis is worse when the dyspnoea is the result of degeneration of the muscle or angina pectoris than when it is due to dilatation secondary to a valvular lesion or to some acute strain.

CARDIAC PAIN. Under this head may be grouped for convenience the various abnormal sensations which have to do with the heart. They range from the slightest disagreeable consciousness of the heart, from slight soreness or aching, or uneasiness, up to agonizing pain. If my own experience is any guide the latter is rare. More frequently even in true angina pectoris the patient will complain of a heavy weight pressing down upon the sternum and making breathing difficult; or there will be aching or soreness in the heart, with occasional shooting pains in the cardiac region or in the left arm, shoulder, neck, or right arm. Sometimes the pains are referred to the stomach and resemble gastralgia, acute indigestion, or the gastric crisis of tabes. I have had two patients die of angina pectoris with gastric symptoms. One died in his first seizure; the other had a number of attacks extending over two years before he had one which was distinguishable as connected with the heart.

How shall we tell whether the pain is due to true angina or not? True angina pectoris is more apt to occur in a man between fifty and sixty years of age who has led a life demanding more or less intense application, or which has subjected him to worry and anxiety. I believe also that the use of alcohol, tobacco, tea, and coffee are contributory causes in many cases. Furthermore, angina pectoris is more frequent in those who show arteriosclerosis, atheroma of the aorta, and aortic insufficiency. Finally, it is the characteristic mode of death in certain families. In 2 cases I have noticed a peculiar hollow or bell-like second aortic sound which may have some diagnostic value. The pulse is not of much value. Early in angina it is usually of high tension. Later it may vary greatly from day to day or even from hour to hour. I have seen it at one visit fairly regular and strong, in an hour unsteady and difficult to count. In some cases there may be marked arrhythmia with great frequency. In the diagnosis of anginal pain one should therefore consider the age and sex of the patient, the family history and tendency, the presence or absence of signs of cardiac degeneration, dyspnoea, oppression, pallor, weakness, etc., and the presence or absence of a cardiac lesion, particularly one involving the aorta.

ARRHYTHMIA. Arrhythmia may have very little prognostic value or a great deal. I saw some years ago, an old gentleman, eighty years of age who had marked irregularity of the heart, which, however, caused him very little disturbance. He told me he had had it for twenty years. Broadbent mentions a similar case. On the

other hand, the arrhythmia which comes on in the late stages of mitral stenosis or aortic insufficiency is of very grave significance, especially if it is persistent. Probably in the mitral cases the sclerotic process has extended from the valves so as to involve the bundle of His. In the aortic cases it may be an expression of serious impairment of the cardiac muscle the result of sclerosis of the coronary arteries. In some of the milder cases the cause seems to be some irritability or debility of the cardiac muscle depending upon a gastrointestinal cause, or upon the effect of coffee or tobacco, or upon some mental stress. In cardiorenal cases one cannot exclude a toxemia of renal origin. A cardio-sphygmogram is of great value in diagnosis and in prognosis.

VERTIGO AND DIZZINESS. As symptoms of cardiac disease vertigo and dizziness may occur in any lesion, but are more common in aortic lesions. One of my patients complained only of an uncertain feeling in her head. She could not always walk straight, and felt uncertain when she started whether she was going to reach her destination or fall down. These symptoms indicate failing heart power and to that extent are of unfavorable prognostic import.

WEAKNESS. The patient may complain most of weakness, of getting tired physically and mentally following very little effort; or the weakness may show itself principally in a difficult digestion with some pallor and malnutrition. These symptoms often indicate some degenerative change in the cardiac muscle.

RESUME. I may say that the prognosis of chronic valvular disease of the heart in private practice is much better, both as to duration and capacity for work, than most persons realize. It is no uncommon experience to find persons who have sustained these lesions for ten, fifteen, and twenty years, in some cases much longer, without either great discomfort or great impairment of their activity. The patients who sustain these lesions longest and with least embarrassment are those of temperate habits and spare build who do not easily become angered or worried and who are controllable as to their mode of life and activities. Those who can lead a quiet, sheltered, protected life naturally live the longest. When death occurs it is usually the result of some accident or intercurrent disease, not directly from the heart.

In estimating the prognosis in a particular case one needs to keep in mind the distinction between a heart lesion and heart disease. As long as there is only a lesion the prognosis is good. A lesion ceases to exist and disease sets in when the heart enlarges and subjective symptoms appear. In my opinion subjective symptoms are better guides to the functional energy of the heart and to its lasting power than are objective signs.

In angina pectoris the duration may be five years instead of the conventional one or two, just as some cases of aortic insufficiency may, under favorable conditions, last for thirty or forty years instead of the ten years which Clifford Allbutt says is the average.

INTESTINAL OBSTRUCTION.¹

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I PRESENT to you today a study of the general subject of intestinal obstruction, with deductions drawn from an analysis of 52 of my private cases taken in succession. The subject will be treated from a diagnostic standpoint, for early and correct diagnosis is still the most urgent need in the treatment of these grave cases. Certain conditions not generally included under the heading of intestinal obstruction are considered, since the total or partial occlusion of some part of the digestive tract was a prominent clinical feature. Many cases of septic peritonitis and similar conditions involving motor paralysis have been noted meanwhile, but are not included in this report.

Of the 52 cases, 29 were males, 23 females; 14 of these were in the fifth decade, 12 in the third, 8 in the fourth, 8 in the first, 7 in the sixth, none in the second; 33 of the patients were operated upon, and 2 others explored, by different surgeons of Colorado, while the diagnosis was established by postmortem examination in 5 other cases. In Case XXXIV the diagnosis was rendered certain by the projection of the intussuscepted bowel through the anus, operation being refused. In 11 cases the evidence as to the cause of the obstruction was clinical rather than anatomical. In 3 of these acute dilatation of the stomach existed, the obstruction being relieved by postural treatment in 2, after continuous fecal vomiting had existed in one for forty-eight hours and non-fecal vomiting in another for the same time. The third patient died unrelieved.

In 3 cases septic paresis of the bowel was regarded as the cause, 1 dying. In 1 case impaction resulted from chronic appendicitis; in 1, impaction of the sigmoid from unknown cause; in 1, motor paralysis from acute pneumonia with diaphragmatic pleurisy; and in 1, paralysis from inflammation about tuberculous glands palpable in the abdomen, all 4 recovering without operation. The last case died from obstruction, associated with the presence of an immense malignant growth in the abdomen of unknown origin, no post-mortem being permitted.

There were in this series 12 cases definitely due to bands or adhesions from previous operation, and 9 not so caused, a total of 21 out of 52 cases. The previous operations were performed for appendicitis five times, pelvic tumor three times, previous obstruction twice, gall-bladder disease and gastro-enterostomy for ulcer,

¹ Read at a meeting of the Montana State Medical Society, Hot Sulphur Springs, May 12, 1910.

each once. The bands or adhesions in the 9 cases not previously operated upon were found to be due to former appendicitis in 6 cases, to pyloric ulcer and tuberculous peritonitis in 1 case each, while 1 case due to an omental band was probably congenital. Obstruction from cancer took second rank—6 cases—in three instances being in the colon, in 2 in the mesentery, and in 1 the exact location was not learned, a large tumor filling the abdomen.

Tuberculous peritonitis caused obstruction in 4 cases, acute dilatation of the stomach (see explanation below) in 3 cases, intussusception in 3 cases, congenital dilatation of the colon in 2 cases, twist in 2 cases, Treitz's hernia in 2 cases, thrombosis of the mesenteric vessels in 2 cases, septic paresis in 3 cases, general adhesive peritonitis, congenital dilatation of the small intestine, congenital pyloric stenosis, paresis from diaphragmatic pleurisy in connection with pneumonia, and impaction in the sigmoid from unknown cause, in each, 1 case.

More than one cause of possible obstruction was present in 5 cases, each being listed above according to the most active agency in producing the obstruction. The complications were: Acute obstruction by bands from old appendicitis, with 4 partial constrictions from tuberculous ulcers also present (operation by Dr. Lyman, recovery); acute obstruction from a band at the site of previous appendicitis and a cancer of the colon on the opposite side of the abdomen, not fully blocking the bowel (operated by Dr. Harris); obstruction from a band from previous operation and congenital small colon dragged down into a V shape (operated by Dr. Lyman, with complete recovery); twist coming on while skipping rope, accompanied by acute tuberculous peritonitis (operated by Dr. Perkins, with recovery from both conditions); obstruction by congenital omental band, Meckel's diverticulum giving opportunity for obstruction, but apparently taking no part in this attack.

In 3 cases the patient had shortly before been made very ill by eating some food disagreeing with the digestive organs, adhesions from recent appendicitis, thrombosis of the superior mesenteric artery, and twist affecting the small bowel being the cause of obstruction in the respective cases. In the first 2 I regarded the food poisoning as the remote cause of the obstruction.

In Case II the congenitally small colon was probably the cause of the operation for obstruction twelve years previously, which operation in turn had caused obstruction by a band.

Case XV was operated upon for appendicitis five years ago, and afterward under my care had four separate attacks of obstruction due to adhesions, and relieved each time by operation by Dr. Dean; two of these were acute in character. She is counted but once in this report.

Of the operated cases, 21 recovered from the obstruction, 1 subsequently dying of uremia. Of the non-operative cases, 8 recovered,

1 subsequently dying of acute pneumonia. Of cases operated upon, 12 died, and also 2 cases in which exploration only was made, hopeless cancer being found, the death being due to the gradual development of the growth. Of the 21 cases operated upon which recovered and the 8 cases recovering without operation, 29 in all, we need say but little here. Let us study the 12 cases operated upon and the 2 explored which were lost, and the 9 cases dying without operation, to see if better results could have been obtained under ideal conditions.

Case VII had been injured in a runaway twenty-four years before, with resulting obstruction, relieved by operation twelve years later. Dr. Wetherill, in the second obstruction, divided constricting bands which had reformed, with relief to the obstruction, but the man died of uremic coma. Probably no better result could be hoped for, for the operation was performed as soon as the obstruction was fully declared, and especial care was taken with the anesthesia because of the presence of albumin and casts.

Case IX was poisoned by eating white fish preserved with formalin, some of the layers of the fish being recognizable in the vomitus on the eighth day. The obstruction came on the ninth day, and was found to be due to thrombosis of the superior mesenteric artery, requiring resection of thirty-six inches of small intestine. In his weakened condition after nine days of vomiting and purging, probably nothing could possibly have saved him. We did not, of course, know of the desperate nature of the trouble before the exploration.

Case II had a twist of the small intestine, and did well until pulmonary embolism occurred, a contingency we cannot guard against. Case XIII was that of a rapidly developing cancer of the colon with acute obstruction, promptly relieved by excision. The operation was necessarily extensive. Death occurred from perforation after several days. The operation was performed by a surgeon of great experience and good judgment, and I believe no better result could have been attained under the circumstances. Case XXXV was a duplicate of the last case in a girl, aged twenty-one years, in the hands of another surgeon equally experienced. Death resulted from the same cause. Case XVI was promptly operated upon, and five separate points of more or less complete obstruction were found resulting apparently from a previous pyloric ulcer, and the operation was, of course, a tedious one. The patient died of shock.

Case XXIV was relieved of the obstruction by a band from a former appendicitis, but died from the shock of a prolonged operation for the removal of a cancer of the colon on the opposite side of the abdomen and which had no part in the obstruction. It was not even suspected until the surgeon felt it in examining the abdomen before closing up the wound after relieving the obstruction. These

cases are always desperate. Case XXVII was the first one of this list that offered a reasonable hope of recovery, but he came to our attention only after eighteen inches of small bowel had become gangrenous from intussusception, and died from the shock of the operation. Earlier diagnosis and operation would probably have saved his life. Case XXXVII had obstruction from an omental band, but was likewise seen too late. Case XL was one of the rare instances of chronic adhesive peritonitis, always fatal so far as I know.

In Case XLI a definite history of ulcer with hematemesis occurring ten years previously was obtained, with normal health until one year before operation. I diagnosticated the scar of a past ulcer not obstructing the pylorus, and an active ulcer at the pylorus with complete obstruction, the latter half of the diagnosis being based upon the obstruction, pain, high gastric acidity, and recent hematemesis with the previously clear history of ulcer. A scar two inches long was found about three inches from the pylorus on the anterior wall, but instead of an ulcer at the pylorus, Dr. Freeman found a small Treitz's hernia with absolute obstruction of the duodenum. The patient did not survive the operation. From the intermittency of the symptoms I believe I should have avoided the erroneous diagnosis of pyloric ulcer, and diagnosticated some intermittent strangulation, though the exact cause was probably not possible of diagnosis.

Case XLIV was one of congenital pyloric stenosis, promptly diagnosticated and operated upon almost immediately by Dr. Lyman on the third day of life; a gastro-enterostomy being performed. The baby died of shock. I do not believe it could have been saved by any method of treatment. Case XLVI was one of Treitz's hernia, the sac containing practically the entire small bowel and the cecum. Gangrene had already occurred before Dr. Freeman was called—another example of unnecessary delay, with death as a result. Cases XLIX and LI were explored and hopeless cancer found—no attempt at relief of the obstruction being possible. Of the cases dying without operation, one baby (Case XXXIV), with intussusception, should have been saved, but operation was refused. Case VI was an imbecile with some type of septic peritonitis causing complete obstruction, and was moribund when seen. Earlier diagnosis should have saved him.

Case XVIII had intermitting obstruction from a band from former appendicitis. Although a physician, he absolutely refused operation. He should have been saved.

Case XXI had thrombosis of the superior mesenteric artery due to syphilitic endarteritis. He was then recovering from syphilitic hemiplegia, and his general condition was so bad that Dr. Freeman and I decided it best not to attempt operation. The autopsy confirmed us in this view of the case. Case XXIII was obviously

a hopeless cancerous mass in the abdomen. Case XXXIII was that of a child, aged eleven weeks, with enormous congenital dilatation of the small bowel with transverse "steps" distinctly shown in the abdominal wall. After seeing the postmortem examination I was confirmed in my view of the utter hopelessness of relief. Case XXXVI had cancer of the mesentery, proved by autopsy to have been utterly inoperable. Case XLVIII had obstruction from the so-called acute dilatation of the stomach, but died from associated aspiration pneumonia. Case LII was one of congenital dilatation of the colon, having, like Case XXXIII, transverse furrows across the abdomen, leading me to make an erroneous diagnosis of dilatation of the smaller bowel. Two feet of the latter were so affected, but the main trouble lay in the colon.

Thus, of the 23 cases lost, 7 had cancerous disease and were practically hopeless from the start. The fatal results in the 2 cases of congenital dilatation of the intestine and those with syphilitic arteritis, uremia, ptomaine poisoning, pulmonary embolism, chronic adhesive peritonitis, and aspiration pneumonia were unavoidable from our standpoint. One of the cases of Treitz's hernia and the congenital pyloric stenosis were on the borderline with the chances against success. Two could probably have been saved if operation had been accepted when offered, and 4 more if seen earlier. Considering the desperate nature of the condition I are studying, I feel that the results obtained are a great tribute to the skill of the surgeons with whom I am associated. Practically, the only way in which the mortality could have been decreased in this series of cases would have been in earlier diagnosis and earlier operation.

Much has been written of acute dilatation of the stomach, yet many of the cases are so ill-defined as to pass unrecognized. The typical vomiting of large quantities of fluid was present in but 1 of the 3 cases quoted. In the other 2 gas was present in the stomach in abundance, but only small quantities of fluid were vomited. The relief of these 2 cases by turning them on the abdomen, with the idea of lessening the constriction of the duodenum by the drag of the mesenteric vessels through the postural change (as suggested in the first one by Dr. Freeman), was very striking.

Case L, of congenital dilatation of the colon, had previously gone ninety days without a stool, and passed forty-five pounds of feces when finally relieved. The baby, aged one year, with a similar condition promised nothing from operation, and died unrelieved.

We should all watch carefully for the cases of threatening obstruction from sagging of the transverse colon. The trouble is so easily demonstrated by the bismuth injection and the x-rays, and relief appears so promising from recently introduced operative procedures, that they should be much less troublesome than they have been hitherto. In several cases that I have seen which fell short

of complete obstruction the relief by fixation in a better position has been very satisfactory, and anastomotic operations promise still more complete relief. No case of obstruction by Meckel's diverticulum nor by gallstone or other foreign body occurred in this series, nor was any observed following concussion of the abdominal wall.

Careful inquiry and physical examination will generally enable us to avoid opening the abdomen in cases of obstruction associated with pneumonia and that occasionally seen in nephritis. In one case of incomplete obstruction not included in this list the development of erythematous and urticarial lesions, hemorrhage from the kidneys, ecchymosis and joint pains decided us against operation, the case being a typical one of erythema with visceral lesions. It fully recovered in a few days under medical treatment.

While studying this series, Dr. H. L. Taylor found it necessary to operate upon one case of obstruction in lead poisoning. He found the small bowel so firmly contracted in certain sections that it was practically a solid cord, and no other cause of obstruction could be found. The patient recovered under purgatives. Such a possibility should be more widely recognized.

The mortality of 767 cases of acute obstruction gathered by Scudder from Willms' compilation, and operated upon by fourteen of the foremost surgeons of Europe, was 351, or slightly less than 46 per cent. Of the 121 cases occurring in the Massachusetts General Hospital, and reported by Scudder, the mortality was 60 per cent.; 33 of our cases were actually operated upon (2 were simply explored), and to make our statistics comparable with those given above 6 are thrown out because of being subacute or chronic obstructions. One case was operated upon twice for recurring acute obstruction, and is counted but once in the list, so that there were in all 28 operations for acute obstruction, with a total of 14 recovering—a mortality of 50 per cent.

Many investigators have studied the varying effects of obstruction at different points in the intestinal canal, and the summary of their views by Scudder presents the subject well. For the diagnostician the important deductions are as given below:

Obstruction is more acute and more dangerous according as its location is higher in the canal. Maury seems to have demonstrated that the earlier mortality in high duodenojejunal obstruction may be due to the absorption of certain biliary poisons normally diluted and suspended in the secretions of the bowel, but in case of obstruction, held and absorbed.

Obstruction does harm because of the infection taking place rather than from its purely mechanical features (Reichel). The paralysis of the wall of the gut, absorption of toxic material, accumulation of gas, pressure effects from this and the associated congestion, blocking of the intestinal circulation, gangrene, perforation,

and death are all dependent upon infection. A general septicemia, in which the colon bacillus takes the most prominent part, is often the final cause of death. The permeability of the wall of the infected loop to bacteria is an important factor, but a poisoning by bacterial toxins may be present without such permeation of bacteria into the peritoneal cavity.

If life is to be saved the advance of pathological processes in the bowel must be averted by early operation. If we could be certain of the obstruction early enough in the case, and have the patient operated upon at once by a competent surgeon, the death rate could be nearly wiped out. Delay comes from non-recognition of the early signs of the obstruction, and hesitation because of fear that the abdomen may be opened unnecessarily. As in so many acute abdominal conditions the physician is so anxious to be absolutely certain of his ground that he too often waits for the advent of marked shock, fecal vomiting, and extreme distention. These mark, not the earliest time for surgical intervention, but the time of such advanced destructive lesions as render the operation one of great danger.

I think every one dealing extensively with acute abdominal disease finds that he recommends operation earlier and upon less absolutely certain signs as his experience increases. The physician's responsibility lies largely in excluding what we might term medical causes for obstruction, such as we may see in uremia, pneumonia, diaphragmatic pleurisy, erythema with visceral lesions, etc. If these be excluded, the surgeon should be called without sacrificing too much time in the attempt to make an exact diagnosis; we should rather take the position of advising operation in any case in which our suspicions of a beginning acute obstruction cannot be set aside by the most careful consideration of all features of the case, than of waiting until we are absolutely certain it has taken place. The price of certainty is too often death, and ten deaths occur from waiting too long where one case is damaged by too early intervention. I have never yet seen the abdomen opened for obstruction without finding abundant justification for the operation. Even cases in which advanced cancer is found should have a chance for recovery if operation can give it to them. A lingering death with fecal vomiting as a termination is so horrible that any reasonable attempt to avoid it even by an operation of great risk should be carefully considered.

The occurrence of sudden abdominal pain, followed by cessation of bowel movement, without material rise in temperature, but with increasing frequency of the pulse, with abdominal distention, often local in the affected loop of bowel (Wahl's sign), and accompanied by visible peristalsis, often with nausea and vomiting, and without the tenderness and involuntary rigidity seen so typically in acute appendiceal, gall-bladder, and stomach lesions, should

suggest acute intestinal obstruction with so much probability that we should avoid opiates if possible, withhold all food, and all cathartics by the mouth, and attempt to relieve the obstruction by enemas. At this time, as Ewald has shown, the stomach contains matter regurgitated by reverse peristalsis from the upper bowel, and the stomach washings should be watched for the first appearance of fecal odor.

Obstructions high up in the canal are generally characterized by greater pain, earlier nausea and vomiting, more flattening of the abdomen, scanty urine, and earlier collapse. Low obstructions are characterized by greater abdominal distention, oftentimes with prominence of certain portions of the abdomen, indicating that the entire colon is distended, or only certain portions of it, or only the small bowel. The prominence of a "horseshoe" of distended bowel in the course of the colon is very striking evidence of obstruction low down, while the absence of this and the presence of smaller prominent loops in the central abdomen suggests that the lower small bowel or cecum is affected. Previous operation suggests obstruction by bands or adhesions. A history of gall-stone disease suggests the possibility of obstruction by a large stone escaped by ulceration into the bowel. In the insane we think of obstruction through foreign bodies swallowed. In patients with diarrhoeal and dysenteric diseases the possibility of obstruction through masses of bismuth or other insoluble medicament is present.

The presence of blood in the stools and a tumor in the abdomen in a young patient with obstruction of sudden onset suggests intussusception.

The beginning of the trouble after such exercise as skipping rope and certain contortions indulged in by boys in the gymnasium suggests a twist. A tuberculous history and the presence of palpable glands suggest obstruction by an acute process connected with a tuberculous peritonitis. A history of typhoid fever, duodenal ulcer, syphilis, or dysentery suggests a gradually contracting cicatrix with a sudden obstruction at the end. Gradual loss of weight and enlargement of accessory glands speak for cancer. Syphilis and toxemic conditions suggest the possibility of mesenteric thrombosis, and serious valvular disease and endocarditis the chance for mesenteric embolism. Blood is generally present in the stools in this class of cases, and was freely vomited in Case XX of my series.

Obstruction without any definite localizing or diagnostic signs speaks in general for some type of obstruction secondary to interference with the circulation of the gut, as from thrombosis or cancer of the mesentery. Obstruction from chronic intussusception is difficult of diagnosis unless the tumor be found. An indefinite obstruction with prominent tumor may be found in volvulus of the omentum.

Rectal examination, investigation of the urine for indicanuria, of the blood for leukocytosis, a well-kept record of pulse and temperature, careful physical examination of the chest, and, in general, the utmost watchfulness should be employed. The mortality will probably be less in the future, as the imperative need of early diagnosis and operation are better appreciated.

I am under obligations to Drs. Cochems, Craig, Dean, Fleming, Freeman, Harris, Lyman, Taylor, Tennant, Wetherill, and Williams, with whom I saw the cases reported, and to Dr. Love for the compilation of the histories.

IDIOPATHIC CIRCUMSCRIBED SPINAL SEROUS MENINGITIS.

WITH THE REPORT OF A SUCCESSFUL OPERATIVE CASE.

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CIRCUMSCRIBED spinal serous meningitis as a distinct disease, has been generally recognized only since 1903, although it was previously described by Schlesinger¹ in 1898, who found such a condition at necropsy. Since then cases have been recorded by Krause² and Oppenheim,³ Bruns,⁴ de Montet,⁵ Mendel and Adler,⁶ and others, and by Horsley,⁷ who in February, 1909, described 21 cases. In this country the first report was made by Spiller,⁸ who in 1903 recorded a successful operative case, reporting it at that time as a cyst in the pia-arachnoid. Since then Bliss⁹ has reported one case and Munro six. It is probable, however, that other surgeons and neurologists have observed this condition, but did not recognize it. This was the experience of Munro.¹⁰

It is of the utmost importance to recognize clinically circumscribed spinal serous meningitis, inasmuch as an early operation

¹ Beit. z. Kennt. d. Rückenm. und Wirbeltumoren, Jena, 1898.

² Verhandl. d. Gesell. Deut. Naturf., 1906, ii Theil, p. 194; Berl. klin. Woch., 1906, p. 827; Verhandl. d. deut. Gesell. f. Chir., 1907, ii Theil, p. 598; Deut. Zeitschr. f. Nervenheilk., 1908.

³ Mittheil. aus d. Grenzgeb., 1906, p. 607; Verhand. d. Gesell. Deut. Naturf., 1906, ii Theil, p. 194; Beit. z. Diag. und Therap. d. Geschw. d. central. Nerv. System, Berlin, 1907

⁴ Berl. klin. Woch., 1908, p. 1753.

⁵ Cor.-Bl. f. Schweiz. Aerzte, 1908, p. 698.

⁶ Berl. klin. Woch., 1908, p. 1596.

⁷ Brit. Med. Jour., February, 1909.

⁸ Univ. Penn. Med. Bull., 1903.

⁹ Jour. Amer. Med. Assoc., March, 1909.

¹⁰ Surgery, Gynecology, and Obstetrics, March, 1910, pp. 235 to 244.

offers prompt relief. So far in all the reported cases the diagnosis of tumor of the spinal cord has been made, and while operation on spinal cord tumors is not always urged, there is no doubt that were this condition promptly recognized operations would be immediately done. It has been asserted that it is impossible to make a differential diagnosis between spinal cord tumor and circumscribed serous meningitis, but we are of the opinion that with the added knowledge which all well-recorded cases give, such a diagnosis can be made, although in our case, as in all of the others, it was not done. One reason for this is the fact that every case in which there is found an excess of fluid at operation is called a serous meningitis, and this should be expected in any newly recognized disease when it is also considered that little is known of its pathology.

PATHOLOGY. Most of our knowledge has been gained from the operative cases and from a few which have come to necropsy. At operations, as in our case, the dura is tense, as if under great pressure, and there is very little or no pulsation and it generally appears bluish and congested. When the dura is opened, as so well described by Munro, a small quantity of cerebrospinal fluid escapes under slight pressure, while immediately the dural slit is filled by a thin, more or less opaque pial membrane that bulges forth under tension of the contained fluid. This fluid is clear and spurts forth as soon as the membrane is opened, when the latter flaps back and forth as a definite curtain attached to the dura and cord and more or less to the nerve roots.

The spinal fluid was examined in one case by de Montet, who obtained it by lumbar puncture, and found many lymphocytes and leukocytes, both being of the same percentage, and large mononuclear cells which resembled large phagocytes. There were no plasma cells or bacteria.

In the cases with necropsy there has been found nearly always some inflammation of the meninges and less often of the cord. Horsley in two cases found tabes and meningogliosis, while others have described tuberculous disease of the vertebræ, meningitis, either tuberculous or syphilitic, syringomyelia, and diffuse sclerosis of the cord. Horsley, who has had the most extensive experience, states that in every case in which he operated, after the escape of the fluid the cord presented a shrunken appearance and a slight yellowish tinge, and he further states that he never operated upon an early case, excepting in one in which the matting of the arachnoid precluded examination of the cord.

There is no question, however, that circumscribed serous meningitis can occur either without disease of the cord or of further disease of the meninges. In our case, after the evacuation of the fluid the cord appeared slightly congested, but was otherwise normal. More important still, every symptom promptly disappeared, as

has been demonstrated by repeated examinations. Such is also the opinion of Bruns, who, in re-recording his case two years after operation, states that most of the symptoms have disappeared, and he believes that there was present no other pathological condition. In reviewing the literature, Bruns was of the opinion that only the cases of Spiller, Mendel and Adler, and one of Krause, besides his own, were examples of idiopathic circumscribed spinal serous meningitis, and he emphasizes the fact that such a condition is possible contrary to the opinion of Oppenheim, who believes that this must be taken guardedly and we should always look for an accompanying intramedullary process. Mendel and Adler were also doubtful as to their case, and thought that it may have been the result of an accompanying tuberculosis. They quote, however, Ströbe, who expressed the opinion in 1903 that idiopathic circumscribed serous meningitis may exist.

Since Bruns' report other cases have been recorded. Of these, de Montet's case is the only one which seems not to have been accompanied by other processes. None of Munro's cases were idiopathic, and Bliss subsequently found a tumor. Horsley states that in all the cases which he operated upon there was present a certain amount of pachymeningitis or gliosis of the cord, but, nevertheless, he is of the opinion that a meningitis alone might have been the sole cause in some of his cases.

ETIOLOGY. Traumatism was undoubtedly the cause of the meningitis in our case, inasmuch as it followed a very severe fall over the right hip and buttock. Similar instances have been recorded by Munro and Bliss, although they were not of the idiopathic type. Oppenheim believes that such a condition is not a sequel of concussion or so-called railway spine. Horsley mentions influenza and gonorrhoea as causes. As has already been stated it occurs in the majority of cases with associated spinal or meningeal diseases.

Little is known of its development, but it is probably due to disease of the pia-arachnoid, which leads, according to Krause, to the formation of adhesions and increased exudation with lessened power of absorption of the secreted fluid in the diseased area. With this there is exerted pressure on the cord and there are also produced vascular changes, this explaining the onset of the symptoms. It is also to be remembered that most of the cysts described have occurred in the posterior part of the cord.

SYMPTOMS. As has already been stated, they resemble almost exactly those of tumor. From the very nature of the growth, however, the symptoms produced by a cyst should differ from those of a hard growth, such as a sarcoma. A cyst, first of all, produces slower developing symptoms, inasmuch as its pressure is more diffuse; and secondly, its symptoms should be of wider range, because in most instances it will be larger than a tumor.

Of course, in those cases in which the cysts are small no differentiation is possible.

As has been indicated by Horsley, the symptoms first point to unilateral involvement, but in the later stages they will be bilateral. Inasmuch as most cysts are in the posterior part of the cord the principal symptoms will be sensory. These are first irritative, and are generally described as a hot, burning, tingling sensation, which, as in our case, may be limited to a root distribution and later become diffuse over the whole limb. Horsley, however, seems to be of the opinion that the pains are never localized to a root distribution, and he considers this one of the most valuable of the minutiae which serve to distinguish this disease from tumor.

Another important symptom which Horsley considers to be present only in serous meningitis is a hyperesthesia which sometimes is present over the whole limb, and he considers this the result of irritation of the roots. This was present also in our case, but was limited over the anesthetic areas, in the distribution of the eleventh and twelfth thoracic and first, second, and third lumbar roots. Another interesting fact was that while touch, pain, and temperature sense were absent over these parts, deep pressure elicited pain, this being present in no other part of the limb. It may have been that there is a relation between the hyperesthesia and the presence of pain on deep palpation, but in the subsequent development of anesthesia upon the other side there was present neither hyperesthesia nor the deep pain. It is an interesting confirmation of Head's observations, and shows that even in the spinal roots deep sensation is transmitted by a different set of fibers.

While pain and paresthesias of various sorts are always present in circumscribed serous meningitis, there may or may not be loss of sensation. Horsley states that in no case has he seen absolute tactile anesthesia, and that it always was relative and sometimes present only to a slight degree and extended over a large area. In our case there was a sharply defined anesthesia for touch, pain, and temperature over the distribution of the eleventh and twelfth thoracic and first, second, and third lumbar roots on one side, later becoming bilateral, and an indefinite relative disturbance for all forms in the rest of the limbs. It is interesting to observe that in the examinations that were made almost daily there were variations of the limits of the anesthesia. De Montet found a similar condition. It must, however, be remembered that there may be variations in the limits of anesthesia in tumor, and that this does not form an absolute diagnostic symptom. It is also interesting to observe that in our case, while the pains and anesthesia varied in different examinations, the upper limits in both were never disturbed and that the variations were always in the lateral and lower parts.

Horsley states that in no case has he observed vasomotor symp-

toms. In our case the right thigh was swollen and the skin did not react to stimulation as well as the left. Just before the operation the patient developed trophic phenomena, consisting of a bluish-red condition of the inner parts of both large toes.

Motor symptoms in some form are always present. They consist of weakness of one limb and later of both, and generally come on slowly, although sudden paralysis sometimes occurs. Munro mentions that in one of his cases the paralysis at times was spastic and then again flaccid. This was also true of our case. In Bruns' case there was an atrophic muscular paralysis, evidently the result of anterior root involvement, besides the symptoms of sympathetic paralysis, such as myosis and narrowing of the palpebral fissure. There was also ataxia in one limb.

The reflexes are generally increased, and there may be patellar or ankle clonus and sometimes a Babinski sign. One interesting fact about our case was that the reflexes varied on different examinations. While at times there would be a great exaggeration of the patellar and Achilles jerks, in the very next examination there would be great diminution or even loss. This variation is mentioned also by Munro and especially by Bruns, who particularly states that several symptoms, such as the pupillary, the reflexes, including in this the Achilles clonus and Babinski, as well as the ataxia and even the gait, were altered on different examinations. He, however, observed this condition after the operation.

For a month before the operation our patient had increased frequency of urination, but there was no disturbance of rectal function. In a number of the reported cases incontinence of urine and feces is mentioned. The patient had great tenderness over the vertebræ, especially over the lower dorsal and lumbar area, the tenderness becoming more marked from above downward. There was, besides, pain on every movement of the vertebræ. Surgically, the patient made an excellent recovery, and at the present time, seven months after the operation, is totally well. Careful examination made several days after the operation demonstrated no symptoms, and she has not complained of paresthesia or pain. In fact, all of her symptoms promptly disappeared. So far as we know this is one of the most successful cases reported, for in all of them instead of a sudden disappearance of symptoms there was a gradual alleviation.

It is unnecessary to urge an early operation, for it is sufficient to mention that Horsley has one patient who is living and well, and who was operated upon ten years previously.

Finally, we believe that the important point upon which a diagnosis can be made of circumscribed serous meningitis is the variability of the sensory and motor symptoms in consecutive examinations. These are, in short:

1. *Sensory*: (a) Pains of a numb, burning character in part or all of a limb which vary from day to day in their distribution, and (b) disturbance of sensation which may or may not be absolute, the limits of which vary.

2. *Motor*: (a) Weakness generally appearing in one limb and later in both, which may be spastic or flaccid on different examinations, and (b) variability in reflexes which may be increased or diminished in consecutive examinations.

The history of the case is as follows:

Dorothy, aged twenty years, single. Family and past history are negative. Two years before she came under observation, while skating, the patient fell and struck her right hip and buttock, this causing some discomfort for several days. About one year afterward she began to complain of a burning, tingling, numb feeling over the anterior and inner portion of the right thigh. The severity of these sensations gradually increased until they became quite marked, and she also complained of them over the whole of the right thigh and buttock. She also noticed that the skin over these parts was sensitive and that the pressure of clothes irritated them. It was not until about two months before she came under our observation, or one year after the beginning of her pains, that she developed a constant aching feeling over the lower portion of her back, especially of the right side, and in the right hip and thigh. The whole right limb now became numb and she complained of a constant aching, dead, or tired feeling, but all this time the burning, hot, and tingling sensations persisted over the anterior and inner portion of the right thigh and hip.

Coincident with the onset of the more severe pains the right limb became a little weak, inasmuch as she tired very easily, and she had to favor this limb when walking; and about one month before she came under observation she could not cross the right limb over the left as well as formerly. At the same time she observed that the right thigh was swollen as compared with the left.

She came under our observation February 19, 1910, when the above history was obtained. Examination demonstrated an area of total loss of sensation for pain, touch, and temperature over the distribution of the eleventh and twelfth thoracic and first, second, and third lumbar roots on the right side, according to the sensory charts of Starr. There was besides an ill-defined disturbance of sensation over the whole right limb and over that part of the buttock which is not included in the above area. This was especially marked for pain sensation. That part of the thigh, abdomen, and buttock in which there was loss of sensation for touch, pain, and temperature was tender to pressure, whereas the other parts of the limb, in which sensation was only partly disturbed, were not. She also at this time complained of the pressure of her clothes,

stating that they hurt her, and that she practically felt no pares-thesis at all with her clothes off, especially when minus her corset.

Examination of the thigh showed an apparent swelling over the upper and middle portions, it measuring one inch more than the left. Stroking the skin produced a white mark, this showing a disturbance of circulation, it not being present on the left. There was a decided weakness in flexing the thigh on the abdomen and in abduction and adduction of the thigh. Movements of the leg upon the thigh were fairly well performed, although there was manifestly some weakness. Every movement of the right leg, whether voluntary or against resistance, caused pain in the right thigh and hip. Both patellar jerks were prompter than normal, the right more so, and there was present an abortive ankle clonus on the right side. There was no disturbance of the bladder and rectal functions or of menstruation.

At the above examination the diagnosis was made of a spinal cord tumor, and she was operated upon about three weeks after the first examination, being examined quite frequently in the interim. In the second examination, which was made one week afterward, the pain had become more severe, and at this time she complained, of a constant hot and burning feeling in the whole right limb and somewhat in the left limb. Examination for sensation demonstrated that the limits of the absolute loss of sensation which were found in the previous examination were widened, but the upper limit was just as it was in the previous examination. It was also found that sensation was markedly disturbed over the whole left limb in a manner similar to the right and that there was a total loss of sensation over the distributions of the eleventh and twelfth thoracic and first, second, and third lumbar roots, the loss of sensation being almost as great as in the first examination on the right side. The pain on the left, however, was not as marked as it was over the right, and there was not present the soreness on pressure or the hyperesthesia on touching the skin which was a prominent symptom on the right side. Subsequent sensory examinations nearly always demonstrated total loss of sensation over the eleventh and twelfth thoracic and first, second, and third lumbar root distributions over both sides, the lateral and lower limits changing, however, but the upper limits were always constant and never varied.

Examination of the back did not demonstrate any curvature, but there was a marked tenderness to pressure over the vertebrae, which began over the eighth thoracic and became progressively more marked over the lumbar and especially over the sacral vertebrae, and was equal on both sides. Lateral movement of the body always elicited pain in the back and especially over the sacrum.

Two weeks before she was operated upon there was a beginning increase in the frequency of urination, but the rectal functions were never impaired. It was also noticed that the inner part of

the right toe became bluish and that both feet were cold. There was at no time loss of power in the left limb. In the two weeks preceding the operation the reflexes on both sides were mostly exaggerated and there was occasionally an abortive ankle clonus on both sides. At no time was there a Babinski sign on either side, the reactions on the left side being always in flexion, while on the right plantar irritation occasionally produced no movement of the toes. It was always noticeable that while the tendon reflexes were nearly always prompt, their degree varied, and on a number of occasions the patellar and Achilles jerks could not be obtained, while in the following examination they would be much exaggerated and a small ankle clonus present.

The operation was performed by Dr. George P. Müller, on March 16, 1910. A vertical incision, about five inches long, was made in the median line, with its centre over the tenth spinous process. The incision was deepened on either side of the posterior spines and the soft parts cleared away from the spines and laminae of the eighth to the eleventh vertebræ. There was not much oozing, and such hemorrhage as occurred was easily controlled by gauze packing wrung out of hot normal salt solution. The posterior spinous processes of the ninth, tenth, and eleventh vertebræ were then removed with bone forceps, and the spinal canal opened with rongeur forceps. After separating the posterior fat, the spinal cord was exposed and seemed to be palpating distinctly, rather congested in appearance, and tense, but not excessively so. A separator introduced above and below the operative field failed to detect any mass or adhesions. A small niche was made in the dura in the median line posteriorly and over the tenth vertebra, a thin membrane forcibly bulged into the wound in the dura, and despite precautions to avoid puncturing this it was opened during the enlarging of the dural wound upward. An immediate gush of clear cerebrospinal fluid occurred, at first forcibly issuing in a jet which was thought to be about one or two inches in height, and subsequently running steadily from the opening, filling the wound and amounting to three or four ounces. It was then seen that the cord was slightly congested, and the remains of the cyst were represented by thin, irregular shreds of tissue; several of these were clipped away with scissors. A separator introduced upward and downward failed to detect any resistance or adhesions, and upon rolling the cord from side to side the anterior roots were observed as being normal. The dura was then closed with a continuous catgut suture, the muscles with interrupted catgut sutures, and the skin with silk. A small drain was introduced at the lower angle of the wound to remove any serum which might collect.

From a surgical standpoint the patient made an uninterrupted recovery, except for the persistence of a sinus discharging cerebrospinal fluid for several weeks after the operation. This sinus

was controlled by elevating the foot of the bed and by a cotton-collodion patch on the back, but would recur again when the bed was lowered and the patch removed. Three weeks after the operation it spontaneously closed. It might be mentioned that urotropin was given throughout the patient's stay in the hospital, no other medicine being required.

DERMATITIS HERPETIFORMIS IN EARLY CHILDHOOD.

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IN a careful and exhaustive communication, Knowles¹ recently discussed the occurrence of dermatitis herpetiformis (Duhring²) in infancy and childhood. A summary of 57 collected cases showed that a neurotic family tendency usually was present, and that a lowering of the general vitality preceded the onset of the disease in a considerable number of instances.

The most frequent type of eruption was the vesicobullous (a point well illustrated in two of Gardiner's³ patients), the papulovesicular and pustular forms being less frequently encountered. Grouping of the lesions was not a marked feature, severe itching was seldom present, and subsequent pigmentation of the affected areas was noted in less than one-fourth of the cases. Under the age of four years the disease was comparatively rare, less than a score of instances having been recorded.

The youngest patient whose case has been published is that of Dauchez,⁴ the infant being a male, aged ten months, in whom the disease first appeared at the age of two months. In June, 1896, Malcolm Morris⁵ exhibited before the Dermatological Society of London an infant, aged thirteen weeks, in whose case a provisional diagnosis of dermatitis herpetiformis was made. Unna⁶ has reported two examples of the affection which began in early life, one in a male of twelve years, who had had recurring attacks since infancy, and one in a male of nine years, in whom the disease first appeared at the age of three years. Thilliez's⁷ patient was also a male, the skin lesions having first developed when the child was three months old, four months prior to the time of consultation. In the case recorded by Heuss,⁸ seen in a male child, aged seventeen

¹ Jour. Cut. Dis., 1907, p. 247.

² Brit. Jour. Dermat., 1909, p. 237.

³ Brit. Jour. Dermat., 1896, p. 278.

⁴ Thèse de Paris, 1895.

⁵ Jour. Amer. Med. Assoc., August 30, 1884.

⁶ La France méd., 1897, p. 801.

⁷ Monats. f. prak. Dermat., August 1, 1889.

⁸ Monats. f. prak. Dermat., 1896, p. 364.

months, the affection had been present, intermittently, for two months. At the time of the report, almost three years later, the manifestations still continued to appear at occasional intervals. Vidal⁹ has reported an instance, in a male, aged twenty years, in which the cutaneous lesions were first noted when the patient was five months old. In Barrios¹⁰ case, which was seen in a female, aged ten years, the disease began at the age of eight months and had persisted for over nine years. Francois¹¹ reports a similar instance in a female, aged twelve years, the disease having begun when the child was one year of age. Payne's¹² patient was a male of eighteen months, and Kugler's¹³ was of the same sex and age. Vanderlinden¹⁴ has recorded the occurrence of the disease in a male, aged two years, the presence of the affection having first been noted five months previously. Jamieson¹⁵ has reported three instances of dermatitis herpetiformis in early childhood, one in a female, aged two years, one in a male, aged two and one-half years, and one in a male, aged eighteen years, the patient having suffered from periodical attacks since his third year. Pringle's¹⁶ case was seen in a male, aged twenty-six months. At a meeting of the Boston Dermatological Society, October, 1904, Bowen¹⁷ exhibited two cases of this disease, one of the patients being a female, aged four years, whose first attack had begun just one year previously. In the ensuing discussion, Dr. Charles J. White¹⁸ spoke of another example of the affection which had been admitted to the skin ward of the Massachusetts General Hospital during Dr. Bowen's service—a male, aged three years; and also of another case, in a female, aged less than three years, that had come into the ward during his own period of service. Later, Bowen, in an article on dermatitis herpetiformis, reported two more cases of the disease occurring in early childhood; both were in females, of the same age—three years.

Durand's¹⁹ patient, a female, aged sixteen years, had suffered from recurring attacks for thirteen years, the initial outbreak having occurred when she was three years old. Roussel's²⁰ historic case (in which circumcision of the patient was followed by the disappearance of the skin disorder) developed in a male, aged three years. One of Gardiner's²¹ patients was a female, aged three years.

During the past nine months I have had under observation a typical example of this affection which began when the patient

⁹ *Annales de derm. et de syph.*, 1903, p. 200.

¹¹ *Ann. de Soc. de méd. d'Anvers*, 1905, lxxvii, 3.

¹² *Annales de derm. et de syph.*, 1903, p. 1901.

¹³ *St. Petersburg. med. Woch.*, 1905, xxx, 487.

¹⁴ *Ann. de Soc. de méd. de Grand* 1891, lxx, 15

¹⁵ *Edinburgh Med. Jour.*, 1891, p. 645.

¹⁶ *Brit. Jour. Dermat.*, 1902, p. 304.

¹⁷ *Jour. Cut. Dis.*, 1905, p. 81.

¹⁸ *Jour. des malad. cut. et syph.*, 1898, x, 533.

²⁰ *New Orleans Med. and Surg. Jour.*, 1900, p. 722

²¹ *Loc. cit.*

¹⁰ *Thèse de Paris*, 1900.

¹⁷ *Jour. Cut. Dis.*, 1905, lxxix, 381.

was nine months old, and has continued, with occasional intermissions, for over two and one-half years. I am indebted to my associate, Dr. J. Phillip Kanoky, for the privilege of reporting the case.

C. K., a male, aged three years and six months. The cutaneous history of the family is negative. Both the father and the mother are living and well. A sister of seven and a brother of two years are living and in excellent health. The mother has had no miscarriages.

The patient, who is of Hebrew parentage, was born in Minnesota, but has lived in Kansas City during the past two years. At birth he weighed seven and one-half pounds, and the delivery was normal. He is of a nervous temperament, but his general health has been fairly good. He was circumcised in early infancy. He has had none of the diseases of childhood, and has never been vaccinated.

When the patient was eight and one-half months old the mother, who had nursed him at the breast up to that time, again became pregnant, and it was decided to place the boy on a diet of cow's milk, with some semisolid food. The change did not agree with the child, and he lost weight, became irritable, and slept poorly. Two weeks after the adoption of artificial feeding the mother first noted a "mosquito-bite" (as she expressed it) eruption on the baby's thighs. A lesion would commence as a reddish macule, which was succeeded by a flat-topped papule, at the apex of which one or more tiny vesicles would form. The development was rather slow, the vesicles appearing in about twenty-four hours. The onset was accompanied by some elevation of temperature. A lesion would persist for a week or more, and then gradually disappear, leaving small scars and some pigment. The mother did not know whether or not there was much pruritus present, but the patient was very restless and fretful during this time.

At the beginning there were about a dozen lesions, but new ones developed more rapidly than the old ones disappeared, and during the first exacerbation, which lasted three months, a score or more of the vesicle-capped papules usually were present.

When the child was twelve months old his general health appeared to undergo a considerable amount of improvement; he ate more and slept better, and the eruption, which had gradually become less marked, disappeared altogether. Then followed a quiescent period of twelve weeks, during which the skin was entirely free from active manifestations of the disorder. This was succeeded by a second exacerbation, much milder in character than the first, which lasted five weeks. The parents and the medical attendant (who considered the affection a severe urticaria) could assign no particular reason for the second attack. Since then the eruption has appeared three or four times in each year, and lasted from

two to six weeks following each appearance. Only the trunk and limbs have been attacked, the face, scalp, and mucous membranes always escaping.

Examination. The patient is a well-formed, exceptionally bright boy. He weighs thirty-one pounds, and appears well nourished. The skin of the head and neck apparently is normal, and the tongue and the buccal mucous membrane are unaffected. There are a few dusky brown pigmented spots on the arms, but no recent lesions of any kind are present.

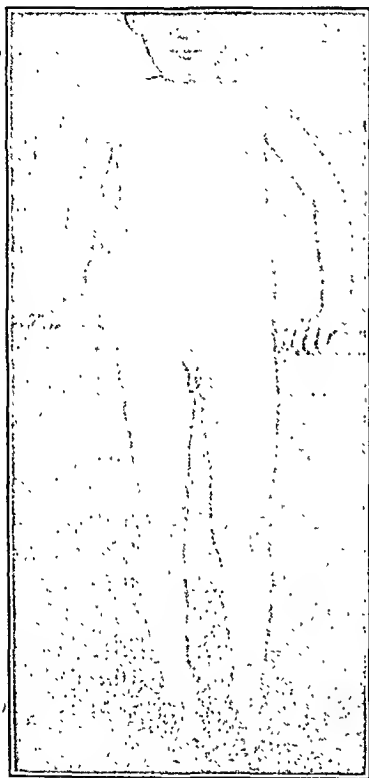


FIG. 1.—Showing the general distribution of the lesions.



FIG. 2.—Groups of vesicles in the lumbar region.

Distributed, in a roughly symmetrical manner, over the trunk and the lower extremities are more than a score of firm, reddish elevations, the tops of which are capped by small, tense, oval vesicles, which vary but little in size and shape (Figs. 1 and 2). There are from three to ten of these minute blisters on each of the elevated areas. The overlying membrane is thick and quite tough. Very few scratch marks are present. Numerous tiny scars can be seen, especially over the lower part of the abdomen, the anterior surfaces of the thighs, and in the sacral region. The pigmentation, also, is more marked in these localities than elsewhere. The palms and

soles are unaffected. There is one recent lesion on the dorsal surface of the right foot. The inguinal glands are enlarged, but are not adherent, and there is no tenderness on manipulation. The thyroid gland cannot be palpated.

The urine is of a rather high specific gravity (1026), and contains a considerable amount of indican (a more or less constant occurrence in this disease, as first pointed out by Engman²²). Repeated examinations have failed to show the presence of hematorporphyrin, demonstrated in some cases of this affection by McCall Anderson.²³

The blood findings in dermatitis herpetiformis are always of interest. Funk²⁴ was the first to note the presence of an eosinophilia in this affection. Roussel²⁵ found these cells present in the proportion of 30 per cent. In Bowen's²⁶ case there were 20.5 per cent. at the beginning of the attack, and 4.5 per cent. during quiescence (a state of affairs which he was, I believe, the first to demonstrate in this disorder). Knowles' patient suffered from the vesicobullous type of the disease, the eruption being accompanied by some itching and burning, especially at night, and differential counts showed 33 per cent. of eosinophiles at the acme of the attack and 21 per cent. during the decline of the outbreak. In the blood of our patient we have never found so large a proportion of these cells. When first examined, two weeks after the commencement and about in the middle of a severe attack, there were present 11.5 per cent. of eosinophiles, 62.5 per cent. of polymorphonuclears and 26 per cent. of mononuclears. In the quiescent intervals the average has been slightly greater than 2 per cent.

Permission to do a biopsy has always been refused; consequently no report on tissues can be made.

Itching has been more or less constant, but it has not been sufficiently severe to give rise to much restlessness or loss of sleep.

The treatment adopted in this case deserves a word of explanation. Two years ago my attention was first drawn to the studies of Leopold-Levi and de Rothschild²⁷ on hypothyroidism in chronic urticaria by a reference in Ravitch's²⁸ paper. These investigators concluded that the absence, or the functional inactivity, of the thyroid gland was accompanied by a general toxemia, and that the cutaneous lesions develop as a result of this intoxication. The experimental work of Reid Hunt²⁹ proved that very small amounts of thyroid will protect mice from poisoning by acetonitril.

²² Jour. Cut. Dis., 1901, p. 358; 1906, p. 216.

²³ Scottish Med. and Surg. Jour., February, 1897, cited by Knowles, loc. cit.

²⁴ Monats. f. prak. Dermatol., 1893, xvii, 266.

²⁵ Loc. cit.

²⁶ Loc. cit.

²⁷ Compt.-rend. Soc. de biol., November, 1906.

²⁸ Trans. 6th Inter. Derm. Congress; Jour. Cut. Dis., 1907, p. 512.

²⁹ Cited by Ravitch, loc. cit.

That a toxic agent of some sort is at times responsible for an attack of dermatitis herpetiformis there can be no doubt, as, for example, in the postvaccination cases of Stelwagon,³⁰ Pusey,³¹ Bowen,³² and Dyer.³³

The use of thyroid as a remedy in practically all forms of skin diseases is not new; in fact, some years ago, following the appearance of Bramwell's³⁴ original communication, the agent was decidedly overused, its employment being, in the vast majority of instances, purely empirical.

Acting upon this theory of Levi-Leopold and de Rothschild, my associate, Dr. Kanoky, and I have employed this remedy in six cases of Duhring's disease in which we thought there was a probability of the presence of hypothyroidism. The fact that marked improvement has followed the administration of the drug in five of the instances makes us feel that thyroid extract is an agent of considerable value in the treatment of selected cases of dermatitis herpetiformis. The results secured were fully as good as one would expect to get from the use of arsenic, quinine, or salicin.

We employ the substance in much smaller doses than are generally advised, seldom giving more than one grain of an active, reliable preparation three times daily, for considerable periods of time. No ill effects have at any time been noted.

Locally, we have found nothing so satisfactory as a lotion containing 5 per cent. of Duhring's³⁵ compound tincture of mineral tar (tinct. picis mineralis comp.), with powdered calamine and zinc oxide. The patient's general condition should, of course, receive attention, and proper hygiene be maintained. The diet should be carefully regulated. Stimulants and excessive amounts of sweets are especially bad. The case here reported has progressed very favorably under this plan of treatment (the thyroid being administered in one-sixth grain doses), but the period of observation has been too brief for us to judge definitely.

To summarize: This case of dermatitis herpetiformis differs from the majority of those seen in childhood in the character of the eruption (papulovesicular), the presence of scarring (which is probably the result of staphylococcic infection), the development of pigmentation, the absence of lesions on the face, and the early age of the patient at the onset of the disease.

³⁰ Jour. Amer. Med. Assoc., November 22, 1902; also Diseases of the Skin, 1907, p. 342.

³¹ Jour. Cut. Dis., 1897, p. 158.

³² Ibid., 1904, p. 265; 1905, p. 381.

³³ St. Louis Med. Gaz., 1898; New Orleans Med. and Surg. Jour., xxiv, 211.

³⁴ Brit. Med. Jour., October 28, 1893.

³⁵ AMER. JOUR. MED. SCI., May, 1894.

RETENTION CYSTS OF THE KIDNEY.

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AN obstruction to the outflow of the urine from the pelvis of the kidney, be it partial or complete, gives rise to dilatation of the renal pelvis, and later of the calices. The increased pressure under which the urine is excreted in the presence of continued obstruction will eventually lead to the development of a cystic tumor. These tumors vary in size according to the kind and degree of obstruction and may attain tremendous proportions. If the cystic contents be sterile urine, simple hydronephrosis results. If a hydronephrosis becomes infected and the contents is mixed urine and pus, uropyronephrosis ensues.

Complete obstruction of the ureter never gives rise to as great dilatation of the kidney as does incomplete obstruction. This is due to the resorption through the cystic walls of the continued, although diminished, renal secretion, thus counterbalancing the obstructed outflow; on the other hand, incomplete obstruction cannot injure the parenchyma of the kidney to the extent that a complete obstruction does. The degree of injury will be determined by the time and degree of the obstruction. Further, in incomplete obstruction the pressure on the renal pelvis is less than that which exists in complete obstruction, because the flow of urine will continue, although in a diminished quantity. If the obstruction gradually increases the dilatation will go on until the sac reaches enormous size. Such a tumor may reach into the pelvis and can easily be mistaken for an ovarian cyst.

The obstruction to the urinary outflow may be situated anywhere in the urinary tract from the pelvis of the kidney to the urinary meatus, although the commonest locations are in the ureter or in pelvis of the kidney where it merges into the ureter. They may be congenital or acquired. The congenital obstructions are anomalies of the ureter: (a) total absence; (b) where the ureter ends in a blind extremity; (c) sharp angulation where it leaves the pelvis of the kidney; (d) anomalous bloodvessels, causing angulation of the ureters; (e) diminution of the ureteral lumen; and (f) pressure exerted on the ureter from without, such as tumors, misplaced organs; etc. These congenital defects may exert their baneful influence at any stage of the individual's career, from interuterine life to old age. If the obstruction be relative, one may go through life with a mild degree of hydronephrosis and never have reason to suspect its existence.

Recently at the Germantown Hospital one of my colleagues was called upon to puncture a large cystic abdominal tumor in a fœtus

which rendered delivery impossible. Upon examination it proved to be a hydronephrosis from a congenital obstruction of the ureter.

In acquired hydronephrosis the obstruction may arise from many causes, the four chief ones being: Compression of the ureter, narrowing of the lumen, obstruction of the lumen, and changes in the position of the kidney by which kinking or twisting of the ureter takes place. The greatest number of cases are caused by an inflammatory conditions of the ureter, such as gonorrhœal, tuberculous, or proliferative ureteritis.

Tumors in the pelvic cavity, especially when fixed by adhesions from old peritonitis; retroflexed or fixed uteri; a calculus lodged in the ureter; tumors of the bladder, etc., are not infrequent causes.

It is obvious that ureteral calculus should cause obstruction of the ureter, but this is not always true, for I have on several occasions removed ureteral calculi that have not resulted in permanent dilatation of the kidney pelvis. Tumors of the bladder, when situated at the ureteral orifices can cause obstruction resulting in retention cysts of the kidney.

The following case will serve to illustrate:

CASE I.—Mr. R. Bad sexual history. Gonorrhœa many times. He complained of an inability to empty his bladder, with periods of marked exacerbations. The stream would be interrupted, bringing on severe vesical spasms. At times he passed considerable blood. There was no stricture, but he had a chronic posterior urethritis. He gave a history of intermittent pain in his left kidney, but never severe enough to cause remark. He never remembers an attack of pain that could be called a Dietl's crisis. A cystoscopic examination showed a papilloma situated at the left ureteral orifice. This I removed in November, 1908. It was pedunculated, and a large piece of the mucous membrane of the bladder was removed with it. The laboratory reported it as suspicious of malignancy. He returned to the hospital several weeks ago. He had no return of the old bladder symptom and no evidence of the return of the growth. He was, however, very anemic and run down. After a few days in the hospital he developed a severe pain in the left lumbar region, with rise of temperature and chill. There was a large tender mass, which could be easily palpated. The urine showed a little pus and a few red blood cells and a few white cells. His leukocyte count was 33,000 on the first day of the attack and fell in the course of four days to practically normal. A large pyonephritic kidney was removed. There was a small papillomatous growth at the lower side of the pelvis springing from one of the calices, which the laboratory reported as epithelioma. Here was a man with an obstruction at the ureteral orifice, with, I believe, a mild degree of hydronephrosis, which later became infected from below, and became, after years, a pyonephrosis.

Let me relate another experience—a case of mistaken diagnosis,

or at least of only suspected diagnosis, and one that taught me a valuable lesson.

CASE II.—Mrs. W., aged forty-four years, was admitted to the German Hospital August 16, 1909. Family history negative. Had typhoid fever eight years before; otherwise her previous history was negative. In January, 1909, she fell downstairs, since which time she has had constant pain in the right side of her abdomen. Pain was dull at first, but later became sharp and associated with nausea. The pain at times was referred to the right shoulder and at times into the right extremity. She had paroxysmal pain, brought on by standing for some time, which was relieved by lying down. She developed frequent micturition, and lately bloody urine after the attacks of pain. She was nervous, had lost her appetite and considerable weight. I diagnosed nephroptosis and operated upon her. She had a floating kidney, but I did not discover a hydronephrosis which she also had, and here is where I learned my lesson. The reason why I did not diagnose the dilated pelvis was, first, because the pelvis was empty when I exposed the kidney; and second, the patient's doctor told us after all was over that she had had several attacks of hydronephrosis, with typical Dietl's crisis, followed by the passage of a large quantity of urine.

To continue the story—four days after the operation a tumor appeared in the upper right abdomen, most prominent under the right rectus muscle. It fluctuated, moved up and down with each excursion of the diaphragm, and was seemingly connected with the liver. It was somewhat tender. I considered two conditions—cystic enlargement of the gall-bladder from infection, or hydronephrosis. Had I known of the Dietl's crisis I would not have gone wrong. I made an incision through the right rectus, twelve days later, and exposed a large peculiar looking cystic tumor, covered by the peritoneum. It was densely adherent to the stomach, gall-bladder, and transverse colon. Upon tapping, urine escaped, and the diagnosis was at once established. It was removed through an incision made at right angles to the original incision in the rectus muscle. The patient made an uninterrupted recovery.

This was, of course, a case of traumatic hydronephrosis, arising in a movable kidney.

This classification of causes does not include the large number of temporary hydronephroses due to kinking or twisting of the ureter in floating kidney, although, from repeated attacks, the ureter may become strictured and give rise to the more permanent although intermittent hydronephrosis.

In the acquired variety the obstructions of the vesicle orifice, as from hypertrophied prostate, or in the urethra, as stricture or phimosis, do not play an important part in hydronephrosis, for the reason that such an obstruction must exert its effects on both kidneys; and as the effects of double hydronephrosis are quickly fatal, one should be prompt to remove the obstruction.

The symptoms of hydronephrosis vary according to the causes. Intermittent hydronephrosis may be attended by violent acute attacks of pain, which are caused by the distention of the pelvis, and if the pressure continues by distention of the capsule of the kidney. These attacks are more violent if they occur in floating kidney, with twisting or kinking of the ureter, plus twisting of the bloodvessels and consequent active congestion of the parenchyma of the kidney. These symptoms are quickly relieved by removal of the obstruction: there is a greatly increased flow of urine, which will show a lower percentage of solid matter.

On the other hand, the cases of slow formation from incomplete obstruction may give rise to comparatively insignificant symptoms and may be unsuspected until the size of the tumor gives rise to discomfort. The size of the tumor gives rise to a sense of tension and pressure, which is exerted upon the neighboring organs, such as, the large bowel or stomach, with symptoms referable to them. These symptoms are those of dyspepsia, loss of appetite, nausea, eructation of gas, thirst, and constipation. If there be sudden increase in the size of the tumor, pain, due to increased pressure, will be noticed; this pain may be referred to the back or to the genitals.

The large tumors will give rise to fluctuation, and will have a smooth, even surface, while the small hydronephrosis from the high tension in the tumor, may feel like a solid growth. The pain, however, is so much more severe in the smaller hydronephrosis that there is little chance of error. Large hydronephrosis is most likely to be mistaken for echinococcus cyst of the liver, cystic dilatation of the gall-bladder, and ovarian cysts; the smaller ones, with their severe acute attacks, for empyema of the gall-bladder and appendicitis.

The diagnostic points between echinococcus cyst of the liver and large hydronephrosis are that the cyst is immobile and cannot be separated from the liver, is permanent, and not intermittent, and the urinary findings of the latter will serve to make a diagnosis. From cystic tumor of the gall-bladder the diagnosis may be more difficult. The history here will be important. The gall-bladder tumor is attached to the liver and cannot be felt in the loin space. The examination of the urine may be the deciding factor in clearing up the case. The following case will illustrate:

CASE III.—Mrs. N., aged forty-two years. The family history and the previous personal history were of no importance, except for an irregular menstrual history of too profuse flow for two years past.

She had been operated on for supposed gall-bladder disease, but her doctor told me that the organ was found to be normal, and so nothing further was done. Her trouble dated back some years, probably seven or eight, but her acute symptoms began three years ago, with frequent attacks of severe pain, starting in the right lumbar region and radiating anteriorly to the right inguinal region and down

the inner side of the thigh to the knee. The attacks were variable in duration and frequency, lasting from one-half to two hours and recurring at intervals of from one to six weeks. At times the attacks were accompanied by chills, generally by nausea and vomiting, and were frequently followed by the passage of a large quantity of pale urine. Between seizures the patient was generally comfortable, except for a sense of "soreness" in the loin on motion or jarring. She has never noticed blood or gravel in the urine. Three weeks before admission to the hospital, after a period of three months' freedom from attacks, the patient had a series of five or six rapidly recurring attacks, very severe in character. These have been accompanied by much gastro-intestinal irritation, chills, fever, and sweats. She had been confined to bed constantly for three weeks past. The soreness in the right side had become progressively more acute and her general condition much weakened.

She is a moderately obese woman; color, pale. Heart: quality of sounds good. Lungs, clear. Abdomen, pendulous; no rigidity. Fulness on the right side, but on account of the thick abdominal walls and great tenderness, no attempt was made to demonstrate a tumor. There is tenderness in the right lumbar region and extending around the loin to the hypochondrium.

Cystoscopic examination showed normal bladder walls and a functioning left kidney; pus from the right ureter. The examination of the urine showed many granular and hyaline casts, traces of albumin, leukocytes, and a few red blood cells, amorphous urates, and epithelium. Examination of the blood showed hemoglobin, 54.0 per cent.; leukocytes, 27,050; polynuclears, 92.0 per cent.; small lymphocytes, 4 per cent.; large lymphocytes, 3.5 per cent.; transitionals, 0.5 per cent. Culture on September 9, 1908, revealed a bacillus of the colon group.

An incision was made beginning just internal to right anterior iliac spine, and continued obliquely upward and outward. A large fluctuating mass was found in the region of the kidney, approximately 9 x 6 x 4 inches and adherent to the peritoneum, diaphragm, and parietes. On incision a large quantity of thin brownish pus escaped. The wall of the mass was found to be a tremendously thickened capsule of the kidney, at the bottom of which a pus kidney was found.

The subsequent history is interesting. The sinus made by the rubber drainage tube in the kidney healed and broke down several times. On one occasion she had started for home and had got as far as Baltimore when it broke open, and she returned to me. I then re-operated, and found the kidney so nearly recovered that I decided not to remove it. The urine from the sinus was clear, the voided urine was normal, and contained practically no pus. The sinus was finally healed by removing the obstruction which existed at the junction of the pelvis and ureter by passing ureteral sounds and

washing out the pelvis of the kidney. It seems to me that this patient had had a hydronephrosis of long standing. She had been operated on for gall-bladder trouble when she had a dilated kidney pelvis. This hydronephrosis became infected later, making, finally, a pyelonephrosis. It also proved the wonderful recuperating powers of the organ and brings into question the advisability of removal of the kidney in all suppurative conditions.

From ovarian cyst one must make a pelvic examination, and if the tumor is ovarian its attachment to the uterine wall will be an important distinguishing feature. The cyst may give rise to the obstruction of the ureter, with resulting hydronephrosis. Under such circumstances, operation would be the only possible means of differentiating. The smaller cysts of the kidney may simulate either empyema of the gall-bladder or appendicitis in a retrocecal appendix. In both latter conditions the constitutional reaction is greater and the pain different. The characteristic urinary findings are absent. The previous history is also of importance.

In appendicitis the pain is at first general, later becoming localized, is paroxysmal, and is followed by vomiting, while in acute hydronephrosis it is more likely to start in the loin and to be referred to the bladder or external genitals. The diagnosis of abscess of the kidney parenchyma from acute appendicitis is not so clear, especially if the appendix be high and the abscess be in the lower pole of the kidney. I have operated such a case. I opened the abdomen for the appendix, which was normal. Upon examining the kidney, I discovered a localized fluctuating mass in the lower pole. A loin incision demonstrated the correctness of the finding. This is an example of hematogenous infection and was secondary to some other focus. Many of the kidney infections are hematogenous and are secondary, and this may be the illuminating fact in the differential diagnosis.

Exploratory operations are justifiable in cases in which a reasonable doubt exists as to the exact diagnosis, and in the class of cases under discussion, in which something must be done to relieve the patient, I would advise such a course. It has been my experience that the classic symptoms of disease as described in our text-books are only averages and are not met with at the bedside one time in ten.

An exact method of estimating the degree of hydronephrosis is by the dilatation of the pelvis of the kidney by means of the ureteral catheter. We can accurately estimate how much fluid is necessary to dilate the pelvis and bring on an attack of colic. If this fluid be of the organic silver salts, an *x*-ray picture will show the exact outline of the pelvis and the position of the kidney. The course of the ureter and any obstruction therein can be photographed by means of lead ureteral sounds, so that a shadow can be seen to be in the ureter or outside, *e. g.*, phleboliths, calcareous glands, etc.

If one of the acute exanthemas or local septic processes is fol-

lowed by attacks of renal colic, pyrexia, chills, etc., one should suspect embolic infection of the kidney. If a suppurative cystitis, especially one complicated with retention of urine in the bladder, prostatic hypertrophy, stricture of the urethra or urinary obstruction from pregnancy, pelvic tumors, etc., is followed by pain and tenderness in the lumbar region, one should suspect infection of the kidney on that side. If the urine, drawn aseptically, contains bacteria in a patient who does not have cystitis, the kidney is shown to be infected. If the urine constantly shows pus, and an enlargement of the kidney can be demonstrated, the diagnosis of a suppurative process is certain, even though it is not possible to say whether the suppuration is in the kidney itself or whether there is pyonephrosis.

A classical group of symptoms which indicates a pyonephrosis is sudden temporary obstruction to the urine, with the rapid formation of a very painful tumor, and the clearing up of the urine, which previously contained pus, the patient meanwhile growing worse. If traumatism precedes such symptoms, the picture is made more clear. If a renal abscess breaks into the pelvis there will be a sudden appearance of a large quantity of pus in the previously clear urine. Here the pain and tenderness in the lumbar region, with marked constitutional symptoms, precede this event, and this in turn will be preceded by some foreign focus of infection.

Cystoscopy will clear up the diagnosis. One can see the pus exuding from the ureteral orifice of the affected side, and, if possible, a specimen should be obtained for further examination. If cystoscopy is impossible or inconvenient, the diagnosis of renal pyuria can be strengthened by irrigating the bladder. When once the water returns clear it will not become cloudy for some little time if the pus is due to cystitis; whereas, if the pus comes from the kidney, it will become cloudy very soon.

Infections of the kidney arise in one of two ways: by means of the blood, or by ascension of microorganisms from the lower urinary tract. Hematogenous infections, until comparatively recently, were considered rare, a belief which is far from being true. This is easily understood when we consider that bacteria in all forms of bacteremia must pass through the kidney, and it is evident that any favoring condition, such as obstruction to the urinary flow or any flaw in the protecting membrane, lining the calices or pelvis, or diseased condition of the parenchyma, may be sufficient to precipitate a suppurative attack in the kidney. It is, therefore, important, in all kidney infections to search for some focus of infection. The germs of measles, scarlet fever, smallpox, pneumonia, typhoid fever, tuberculosis, and tonsillitis all pass through the kidney. *Bacterium coli*, staphylococci and streptococci likewise pass through the kidney, and the original focus for their generation must be looked for and considered.

The second method is by ascending infection along the ureter and the order will be: ureteritis, pyelitis, pyonephrosis, and finally involvement of the entire kidney structure. The gonococcus is the most common cause, although a number of other bacteria are frequently found to be the etiological factors—*Bacillus coli*, *staphylococcus*, *streptococcus*, *Proteus vulgaris*, etc.

Renal tuberculosis may occur as an original primary focus of infection in the body of the kidney without involvement of the ureter or bladder. It is usually secondary to foci in the other parts of the body, such as the lungs, vertebrae, etc. If the point of infection be in the kidney, it may not give rise to symptoms of sufficient severity to attract attention. Such a tuberculous collection may remain free from other infection. When, however, the pelvis is involved, as it frequently is, we usually find the other organism working with the tubercle bacilli toward the destruction of the organ. In other words, we can have a single tuberculosis of the kidney, tuberculous pyonephritis, and tuberculous hydronephrosis.

Frequently the first symptoms of kidney tuberculosis is a persistent intractable vesicle tenesmus in which there is no anatomical evidence in the bladder mucous membrane or chemical evidence in the urine to account for the symptoms. It is well to remember this point, as it is always suspicious, and should lead to a thorough investigation. Later, the cystoscope will usually show around one or other of the ureteral orifices points of redness and swelling in the mucous membrane. The urine shows many changes and alterations, depending on the location and kind of infection.

The symptoms which are most marked are: polyuria, pyuria, hematuria, albuminuria, vesicle tenesmus. Occasionally the urine will become temporarily clear, from a blocking of the ureter of the affected side, and hence a flow of normal urine from the normal kidney. With the blocking there is an increase in the size of the affected kidney. The other symptoms are those which are characteristic of tuberculosis in other parts of the body—loss of weight, disturbances of digestion, loss of appetite, hectic temperature, sweats, and chills. If in addition to these symptoms we can demonstrate a tender swelling in the lumbar region, and can find tubercle bacilli in the urine, and especially if we secure the urine from the affected side by ureteral catheterization, we can be sure of the diagnosis. The absence of tubercle bacilli in the urine is not proof that tuberculosis of the kidney does not exist.

Locally, we can usually make out an enlargement of the kidney which will increase steadily, with sudden increase, if the ureter becomes blocked. This tumor may give rise to pain and tenderness, although these symptoms are common to all infections of the kidney. The pain is due to distention of the pelvis from blocking of the ureter or to inflammatory congestion.

Hematuria is always a grave symptom and its cause should be carefully searched for. It is frequently the first indication of tuberculous disease of the kidney. Professor Schede has this to say:

"In making a differential diagnosis, it is well to remember that hemorrhage, pain, and enlargement of the kidney are caused by a calculus, or a newgrowth, as well as by tuberculosis, and that the pain and enlargement may be due to kinking of the ureter, and congestion to the influence of bacteria, and that pain, enlargement, and pyuria are caused by non-tuberculous suppuration of the kidney, and that vesicle symptoms and tubercle bacilli in the urine may be due to tuberculosis of the bladder. Therefore, hemorrhage, pain, and renal enlargement are not characteristic; and even if the presence of a calculus is definitely shown by the *x*-rays, it may have developed secondarily to tuberculosis, or tuberculosis may follow the formation of a calculus. The local reaction following an injection of tuberculin is a characteristic sign which does not appear under other circumstances, and a general reaction after the injection is an almost certain proof of the presence of a tuberculous foci somewhere in the body. In the present state of our knowledge of the treatment of renal diseases such a fine differential diagnosis is generally not important. If it can be shown that there is present either suppuration or calculus in the kidney, or renal tuberculosis, or a neoplasm, the duty of the surgeon is to expose the kidney, and, if necessary, to split it open in order to determine the nature of the disease, and to apply such measures as are indicated."

REVIEWS.

A MANUAL OF OPERATIVE SURGERY. By SIR FREDERICK TREVES, Bart., G.C.V.O., C.B., LL.D., F.R.C.S., and JONATHAN HUTCHINSON, F.R.C.S., Surgeon to the London Hospital. Third edition; in two volumes. Vol. I, pp. 775; 209 illustrations. Philadelphia and New York: Lea & Febiger, 1909.

WHEN the first edition of Treves' *Operative Surgery* appeared (1891), the reviewer in this journal was of the opinion that it was "the most comprehensive and at the same time the most clear and concise manual of operative surgery which had been written in modern times." The second edition (1903), revised by Mr. J. Hutchinson, Jr., was still thought to merit commendation as to the "excellent average judgment displayed in the difficult task of selecting from among thousands of varying procedures those most worthy of description," and as to the manner in which the information thus gathered was presented. This latest edition (1909) has—as to this present first volume—been partly rewritten by Mr. Hutchinson, and has been, in the main, thoroughly revised. The retirement of the original author from all active professional work preceded the appearance of the second edition, and it is to be assumed that the editor is now solely responsible for the changes made and for the opinions expressed. In the main, these are in the direction of improvement, and the original opinions above quoted may be reiterated. There is shown, however, a tendency to emphasize somewhat excessively the work and teachings of British surgeons, which has militated against the thoroughness of this revision. We find, for example, that there are approximately between three and four dozen references to American surgeons (living and dead), and between 350 and 400 to English surgeons. A large portion of the book is devoted to abdominal surgery. We find one reference to the Mayos (in relation to the operation for the radical cure of umbilical hernia), and nineteen references to Moynihan, and twenty-four to Mayo Robson. In that part of the book relating to genito-urinary surgery, there is a similar disproportion. Keyes, Watson, and Young are referred to five times, while Henry Morris, Fenwick, and Freyer are quoted twenty-eight times. We are very far from saying that any of these references should be omitted. The admirable work done by these representatives of British surgery is familiar

to all of us. But we are equally sure that in a comprehensive book on operative surgery of the abdomen and of the genito-urinary tract, no such disproportion as to achievement, either in particular work, in original additions to methods and instruments, or in contributions to surgical literature, exists today as would seem to be indicated by the above figures. The apparent lack of familiarity with the work done in this country extends to the use of proper names. "Mr. Bloodgood" and Mr. "Cushing" and "Dr. Richardson of Harvard" look unfamiliar to American eyes.

In 1891 a preference for British surgery may have been justified, although, in the first edition of Jacobson's *Operations of Surgery*, which appeared in 1888, the references to American surgery were notably full and numerous. In 1903 the basis for such a preference had certainly largely disappeared, not because of any falling off in British surgery, but by reason of undoubted improvement in this country. In 1909 there can be no question that we can each learn from the other to at least an equal extent.

Following out this line of thought, it would be possible to note a number of omissions of more or less importance. It seems a pity, for example, that when there was room for the humorous (?) statement, that "it is told of one surgeon that before driving to an operation his carriage wheels were always washed over with ether and carbolic solution," there was not also room for a description of the operative methods now so widely used in cases of acute diffuse peritonitis. Some very minor criticisms are also justified, as, for example, the arrangement in the table of contents, by which the heading of Part II—"Abdominal Operations" (also continued as a running page heading through part of the volume)—is made to seem to include urethrotomy, perineal prostatectomy, operations on the ruptured perineum, etc. But, on the whole, the care, the wide research, and the sound judgment of the original author, with the additions made by the editor, still maintain the position of the book as one of very distinct usefulness to the operating surgeon.

J. W. W.

CLINICAL EXAMINATION OF THE URINE AND URINARY DIAGNOSIS.

By J. BERGEN ODGEN, M.D., Medical Chemist to the Metropolitan Life Insurance Company, New York. Third edition. Pp. 427; 54 illustrations. Philadelphia and London: W. B. Saunders Company, 1909.

THE former editions of Odgen's work on urine analysis appear to be so well known that the third edition of this book, which has been recently published, hardly requires extended comment. The author states that in the new edition the subject matter has been thoroughly revised so as to conform to the numerous advances which

have of late taken place in this important branch of clinical pathology. In view of such an assertion it is particularly disappointing to note a number of important omissions.

In the chapter on the chemistry of the urine it is somewhat surprising to find that all reference to ammonia and its quantitative estimation has been omitted; in spite of the fact that it is generally conceded that in conditions such as diabetes the quantity of ammonia in the urine furnishes a valuable index of the degree of acidosis present. Among the tests given for the detection of urobilin no mention is made of the dimethyl-amido-benzaldehyde method, one of the simplest and best of the newer tests. Further on, while discussing the carbohydrates, the author completely ignores levulose and maltose, although he devotes over two pages to laiose and inosite. Levulose at least, it would seem, merits mention, in view of the significance attached by some to the production of levulosuria in certain lesions of the liver. Again, a useful addition to the paragraph on the detection of acetone would have been a description of Lange's test, now regarded by many as superior to the older tests of Legal and Lieben which are given.

The selection of quantitative methods has been carried out, upon the whole, satisfactorily. Exception, however, may be taken to the method described for determining the acidity of the urine, which is regarded by most physiological chemists as inaccurate and much inferior to the method of Folin of which no mention is made. Also, among the several methods given for the quantitative estimation of urea, the more convenient method devised by Folin has been omitted.

The chapter devoted to the consideration of urinary sediments and calculi are most complete and deserve only favorable criticism. The value of the one on urinary sediments is decidedly increased by the presence of a large number of clear and useful illustrations.

The second part of the book furnishes its most original feature and should strongly appeal to clinicians. In it the author applies the information obtained by analyses of the urine to the diagnosis not only of disease of the urinary tract, but also to a number of other diseases characterized by noteworthy urinary findings. Particular emphasis is laid upon the various abnormalities of the urine met with in the separate types of nephritis and different stages of the same type. Odgen points out with truth that as yet we are unable to differentiate either clinically or in the laboratory, the several pathological varieties into which acute diffuse nephritis is commonly divided. It is also gratifying to note that the author adheres to a simplified rational classification of nephritis, although he does complicate matters somewhat by describing a third form of chronic nephritis, termed chronic diffuse nephritis, in addition to chronic interstitial nephritis and chronic parenchymatous nephritis, which he prefers to designate "subacute glomerular nephritis." While discussing the urine of diseases other than renal, it is rather remark-

able that the writer has entirely overlooked the urinary changes attributed to chronic pancreatitis, although the less characteristic changes in the urine of such conditions as melancholia and acute myelitis are mentioned. In this connection it should be pointed out that nowhere in the book is there any description of the now well-known and frequently discussed Cammidge reaction.

By reason of the somewhat elementary manner in which many of the subjects are dealt with, in addition to the sundry omissions, it must be confessed that Odgens' book can hardly be regarded as of great value to the physiological chemist and clinical pathologist. Among students and practitioners of medicine, however, for whose use it was especially designed, the new edition of this work should continue to enjoy the same popularity as the earlier editions. Since an entirely new section has been added on the examination of urine for life insurance, the present edition may also be expected to be particularly welcome to the many interested in that line of work.

G. M. P.

DISEASES OF THE STOMACH. BY S. H. HABERSHON, M.A., M.D., F.R.C.P. Pp. 565; 19 illustrations. Chicago Medical Book Company, 1910.

THIS is a compact work in which there is much to praise. The style is clear. The illustrations are excellent and are distinctly illustrative. Those in the first part of the book showing models of the abdominal viscera *in situ* are among the best published, and some in the back part of the book illustrating pathological conditions, many of them colored, are equally satisfactory. There is a preliminary section of fifty pages on anatomy and physiology and another of fifty upon the discussion of diet. It will be noted, no doubt, that there has been a slight confusion in the use of the term calorie. The author objects very much to twice cooked meats and particularly to the strong sauces in which they are served, because they may cause biliousness and bilious attacks, whatever these may be. Seven pages are devoted to physical signs and they are most inadequately described. Indeed, all through the book, physical examination is neglected to a very serious degree. One sign that he describes appears to be new, that is in cases of spurious gastric ulcer, obliteration of the carotid artery during the palpation of the stomach will cause the local tenderness to disappear. He places great faith in the coin method of auscultatory precussion. The section on the examination of the gastric contents is fairly satisfactory. The forty pages devoted to symptomatology are enough, particularly as the symptomatology of the various conditions is given quite fully. Eighty pages are devoted to dyspepsia for which a very

elaborate classification is devised. It is probably fair to say that such a classification, while evidence of the author's ingenuity, is of comparatively little value in clinical medicine. Fifty pages are devoted to gastric disorders in their relation to general disease. There is then a discussion of the various forms of gastritis, a very good description of gastric ulcer with excellent utilization of the literature, not perhaps the most modern part. The diagram on page 379 is rather difficult to understand, as it would appear that at certain ages everyone must have gastric ulcer. The section on ulcer of the duodenum is entirely inadequate and the same may be said of that on gastropnoxis. The subject of carcinoma is, however, well discussed, although the physical signs and symptomatology might have been given fuller treatment.

In conclusion we wish to quote the author's opinion upon some of the modern terms suggested for gastric conditions. "The matter of classification is not elucidated by the introduction of a classical nomenclature which is adopted by many Germans and Americans. Some terms are valuable because they carry their meaning with them or are consecrated by old and familiar usages. Other terms . . . are unintelligible to the ordinary reader, though they may show the erudition of the author or his classical ingenuity."

J. S.

MODERN PROBLEMS IN PSYCHIATRY. By ERNESTO LUGARO, Professor Extraordinary of Neuropathology and Psychiatry in the University of Modena. Translated by DAVID ORR, M.D., and R. S. ROWS, M.D., LL.D. Pp. 305; 13 illustrations. Manchester, England: University Press, 1909.

LUGARO's work has been well known for many years, and all English-speaking physicians should be indebted to the translators for their painstaking and earnest work. The text is divided into eight parts. The foreword is written by the well-known English Alienist, T. S. Clouston, M.D. In this Dr. Clouston has written an excellent review and criticism of the book, and the present reviewer can do no better than quote from him: "I had not read much of the translation before I found that Lugaro was one of the master spirits of biological science, who, while knowing and using the details and facts of his subject, was not content with a narrow and technical view of it, but pressed into its elucidation all the correlated sciences of anatomy, physiology, biology, and psychology. Some other men have before attempted to do this, but, while mustering many of the facts of those sciences, failed to show their exact bearing on the subject of the mental disturbances and defects of the human brain. Lugaro seems to me to have been able to set the

whole problem of psychiatry before his mind, to have realized its extraordinary difficulties, and to have pointed out future lines of research more clearly and fully than almost any of our modern authors. He combines caution with scientific enthusiasm. He avoids immature inductions. He knows just how far his facts will take him. He is not carried away by impractical theory as so many authors of the Latin races have been. He is reliable and practical, while retaining the subtle mental qualities of his race. He does not offend the common sense of the average man nor the conservatism of the lawyer in his conclusions and advice as to how criminals and cranks should be treated by society. He gives the impression that he would be a safe guide in the witness box, at the bedside, or to the social reformer.

"We Britons needed such a clear, logical, and illuminating treatise. Even its abundant theorizing will stimulate us to think. It is wider in its scope and more philosophical in its methods of treating the subject than any book of our own. In short, it exhibits more of the scientific spirit. All our alienists and most of our physicians will do well to peruse it."

T. H. W.

ESSENTIALS OF LABORATORY DIAGNOSIS. BY FRANCIS ASHLEY FAUGHT, M.D., Director of the Laboratory of the Department of Clinical Medicine, Medico-Chirurgical College, Philadelphia. Second edition; pp. 336; 44 illustrations. Philadelphia: F. A. Davis Company, 1910.

THE author has made several changes in the second edition of his *Essentials of Laboratory Diagnosis*; these include short additional sections on serodiagnosis, in which the Wassermann reaction is discussed; on the special methods for the detection of tubercle bacilli (including the use of antiformin); and on the determination of pancreatic activity by a new method. The section on opsonins is materially shortened, and the technique, which appears in detail in the first edition, is omitted; while the section on blood pressure has been re-written and considerably amplified. The microscope and its accessories are fully described in the first section, but one cannot agree in all the details with the author's exposition of the subject. There are omitted in Section III, descriptions of the Tallqvist method of estimating hemoglobin and of the blood changes in Hodgkin's disease, each of which is sufficiently important to justify incorporation with the text. Section V, on blood pressure, is well written and contains many references to literature; however, its length is out of proportion to the other sections. Sections III and VII, on blood and blood parasites, respectively, might have

been combined systematically and the text enhanced thereby. Section IX makes no reference to the Oppler-Boas bacillus in gastric analysis; and under urinalysis, there is, likewise, no reference to the qualitative and quantitative estimation of oxalates and to the quantitative estimation of sulphates. The Cambridge reaction is discussed in short, but the "modus operandi" noted in the first edition has been omitted. The text contains not a few typographical errors repeated from the first edition. As the author states, the volume is intended to contain only the "essentials of laboratory diagnosis," so that much material has been intentionally omitted. A critical review shows a text which, on the whole, is commendable, notwithstanding the rather numerous points of adverse criticism which one should not unduly emphasize. The volume should be of assistance to the laboratory worker.

W. T. C.

THE CAMPAIGN AGAINST MICROBES. BY ETIENNE BURNET, M.D., of the Pasteur Institute. Head of the Vaccination service of the city of Paris. Translated from the French by E. E. AUSTEN, F.Z.S. New York: William Wood & Co., 1909.

IN the present day, when medicine is given such publicity and, aside from a certain idle curiosity, is a subject of real interest to many intelligent persons in no way associated with the medical profession, a book such as this is bound to receive well-merited attention, and will be read with absorbing interest. The title is not especially well chosen, for it smacks of an attempt at popularity not altogether pleasing. The book, however, is a revelation and of such absorbing interest that it is with difficulty that one puts it down. A half dozen problems of the utmost importance to the public health and safety are discussed in a truly scientific manner, but at the same time presented with such simplicity and clearness that they are made intelligible to the average cultivated individual. These problems are cancer, tuberculosis, tetanus, sleeping sickness, enteritis, and variola and vaccinia. The papers reflect the latest views upon these subjects and bring out in a highly interesting and accurate way the recent development of our knowledge concerning these problems. It is quite natural that though the results of investigation by the German, English, and American observers are given due credit, still the prevailing ideas come from the Pasteur Institute. This is particularly noticeable in the section on cancer, where the work of Borrel is discussed, and in the chapters devoted to the role of intestinal microbes in enteritis, where the work of Metchnikoff is discussed in full. We could not imagine a better work to put into the hands of the public and at the same time a more readable and interesting book for the profession. W. T. L.

A TEXT-BOOK OF PHARMACOLOGY AND THERAPEUTICS; OR, THE ACTION OF DRUGS IN HEALTH AND DISEASE. By ARTHUR R. CUSHNY, M.A., M.D., F.R.S., Professor of Pharmacology in the University of London; Examiner in the Universities of London, Manchester, Oxford, and Leeds; formerly Professor of Materia Medica and Therapeutics in the University of Michigan. Fifth edition; pp. 744; 61 illustrations. Lea & Febiger: Philadelphia and New York, 1910

WHEN first published Cushny's *Pharmacology and Therapeutics* immediately took front rank as a volume representing therapeutics as a science and tending to replace the drug empiricism of the past with scientific data based upon the ascertained actions of drugs. During the eleven years that have since elapsed the volume has become a standard text-book, and five editions have been called for; the latest represents a thorough revision. Many changes have been made throughout. The discussion of certain drugs of minor importance has been curtailed; some have been excluded altogether from consideration, in accordance with the tendency to abandon the use of drugs feeble, uncertain, or untrustworthy in their action, and to substitute therefor others of proved efficacy and trustworthiness. The most important changes comprise modifications and amplifications of the discussion of a number of important drugs, such as digitalis, ergot, adrenalin, etc., in accordance with the results of recent experimental and clinical observations; the incorporation of new points of view in regard to certain more or less specific remedies, such as arsenic and mercury, that have followed the investigation of trypanosomiasis and other protozoal infections; and the inclusion of the essentials of antitoxic remedies. But there are many other important changes and additions that bring the book fully abreast of the times. Professor Cushny points out the growing interest in the actions of drugs and their application and the abandonment of the nihilistic attitude toward therapeutics; and his book very well reflects these points of view.

A. K.

THE VEGETABLE PROTEINS. BY THOMAS B. OSBORNE, Ph.D.,
Pp. 125. London: Longmans, Green & Co., 1909.

UNDER the joint editorship of Dr. R. H. Aders Plimmer and Dr. F. G. Hopkins ten monographs on biochemistry have been published, each monograph being written by an author who is himself working at the subject with which he deals. As the editors state in the general preface, it is impossible for text-books to deal adequately with the subject of physiological chemistry without being cumbersome, and, furthermore, the subject has been growing

so rapidly that new editions of text-books are issued when much of their contents has become obsolete. "For this reason an attempt is being made to place this branch of science in a more accessible position by issuing a series of monographs upon the various chapters of the subject, each independent of and yet dependent upon the others, so that from time to time, as new material and the demand therefore necessitate, a new edition of each monograph can be issued without re-issuing the whole series. In this way both the expenses of publication and the expense to the purchaser will be diminished, and by a moderate outlay it will be possible to attain a full account of any particular subject as nearly current as possible."

Dr. Osborne, who has done so much research in the chemistry of the vegetable proteins, has written a noteworthy monograph on this subject, summarizing with a rare combination of brevity and clarity the work to date of himself, co-workers, and others. The monograph lends itself poorly to a review, but it is to be recommended to all those whom the subject interests, for the book will be found to be a complete compilation with full bibliography of the work published on the vegetable proteins. E. H. G.

THE PRINCIPLES OF HYGIENE. A PRACTICAL MANUAL FOR STUDENTS, PHYSICIANS, AND HEALTH OFFICERS. BY D. H. BERGEY, A.M., M.D., Assistant Professor of Bacteriology in the University of Pennsylvania. Third edition; pp. 555; 62 illustrations. Philadelphia: W. B. Saunders Co., 1909.

THE third edition of this well-known book presents much the same form as its predecessors. The changes and additions are not numerous except in regard to immunity, which has been largely rewritten. The principles of the newer methods of treatment by the production of immunity have been added, and the use of inactivated bacteria as well as the newer sera, such as that of Flexner for cerebrospinal meningitis, are briefly discussed. The subject of hygiene is a large one and necessarily touches many and various subjects, so that the difficulty of selecting properly and condensing the material into a comparatively small volume is not always simple. This part of the task the author seems to have admirably accomplished, and the book will continue to be of value as a presentation in a brief and modern manner of the subject of the principles of hygiene. G. C. R.

PROGRESS OF MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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Hemophilia.—On the basis of four cases, SAHLI, in a previous communication (*Ztschr. f. klin. Med.*, 1905, lvi), emphasized that: (1) The leukocytes are normal or slightly decreased in number, with relative increase of lymphocytes; the number of blood plates is normal. (2) The alkalinity and freezing point of hemophilic blood is unchanged. (3) The fibrin content is not decreased. (4) The single characteristic feature of hemophilia is the prolonged coagulation time. After considerable loss of blood the coagulation time decreases, and may reach normal limits. These observations he confirms upon two new and one of the previously studied cases; he then considers the nature of the disease. The coagulation of hemophilic blood is increased by the addition of defibrinated blood which has been rendered fibrin-ferment-free, by heating to 60° to 62° for half an hour. This points to thrombokinase—not thrombogen—as the substance which is decreased in hemophilic blood. Normal blood serum, after removal of fibrin ferment by heat, also accelerates the coagulation of hemophilic blood, though less strongly, indicating that thrombokinase is normally to a certain extent excreted by the corpuscles into the serum during coagulation. Normal corpuscles washed ferment-free, strongly increased the coagulability when added to hemophilic blood, while similarly prepared hemophilic corpuscles produced a like but very slight effect. Hemophilia is, therefore, a disease due to a decreased content, or decreased availability of the thrombokinase, in the blood corpuscles. Whether this is an anomaly of the erythrocytes, leukocytes, platelets, or of all three, is uncertain. Repeated injections of fresh human serum; and repeated small bleedings to stimulate the physiological reactive thrombokinase-formation are recommended.

Ochronosis.—POULSEN reviews 16 previously published cases and contributes 9 new ones (*Beitr. z. path. Anat. u. z. allg. Path.*, 1910, xlviii, 346). Of the 25, 13 were in men, 12 in women. The average age was fifty-four. Fourteen have come to autopsy with uniformly characteristic lesions. Of the 11 unautopsied cases (10 of which are still alive), the characteristic pigmentation of the cartilages of the nose and ear, the brown scleral spots, and the presence either of alkaptonuria or the history of long continued application of carbolic acid to chronic ulcerations, leave no doubt as to the diagnosis. The pigment has characteristics of an acid in that it dissolves in alkalies. At the same time, it is to a certain degree amphoteric. It contains 2.44 per cent. S, but no Fe, and it gives no absorption spectrum. It stands nearest, as Hecker, Wolf, and Pick have agreed, to melanin. Clinically, pigmentation has been noted in the ears of 18, in the sclerae of 14, in the nose of 7, in the skin of 10, the finger nails of 1, and the tarsal cartilage of 1 of these 25 cases. Pathologically, the costal cartilages, intervertebral disks, articular surfaces of the large bones, and the tracheal rings are constantly found pigmented. The epiglottis and laryngeal cartilages are usually less deeply colored. The ligaments are affected in about one-half, the tendons, particularly near their insertions, in nearly two-thirds of the cases. Discoloration of the bones has been noted in less than one-half the cases, and was never extreme. Of the internal organs, the intima of the heart or aorta was pigmented in 11 of 12 cases; the kidneys, though frequently only after microscopic examination, showed pigment in 7 of 11 cases, the liver in 2, and the intestine and dura in 1 case each. In cartilage, the deposition is in the matrix, the capsule and cells being spared or little affected. An exception to this is in injured cells which are strongly pigmented. In cases with arthritis deformans, the cartilage is now deeper (Pick), now little (Hecker and Wolf, Poulsen I.) colored. The chief deposition of pigment is near the more vascular areas. In the kidney, Poulsen found pigment in the epithelium of the convoluted tubules.

Deviation-of-the-Complement in Typhoid Fever.—CATHAIRE (*Comp. rend. Soc. de. biologie*, 1910, lxi, 117) employed in the diagnosis of typhoid fever the so-called rapid Wassermann method of fixation-of-the-complement used for the diagnosis of syphilis. The natural hemolysin was used which human serum contains for sheep corpuscles, and the complement of normal blood. The antigen was an alcoholic extract of a spleen removed at autopsy from a typhoid patient who died on the fifteenth day of the disease. The serum of the patients was taken on about the tenth day. One-tenth c.c. of serum was used with 0.1 to 0.2 dilutions of antigen. After an hour in the thermostat, 0.1 c.c. of sheep corpuscles washed and diluted to 0.05 was added. Of 15 patients examined, a deviation-of-the-complement was obtained with antigen dilution of 2 in 10, in 7 instances; in 8, with 1 in 10. All foreign sera tested showed no deviation in the same dosage.

The Experimental Production of Actinomycosis in Guinea-pigs Inoculated with the Contents of Carious Teeth.—ISRAEL, in 1878, noted the presence of carious teeth in three of five cases of actinomycosis. In one of the three he demonstrated the parasite of the disease not only in

the pus of a subperiosteal abscess of the lower jaw, but also in the root canal of an extracted, neighboring, carious molar tooth. He inferred that the parasite was harbored in carious teeth. Wright prophesied, in 1904, that actinomyces might be found as a normal inhabitant of the buccal cavity and alimentary canal. The uncertainty of the origin of the disease attracted the attention of LORD (*Boston Med. and Surg. Jour.*, 1910, clxiii, 82), who had already noted the frequency of the organisms in sputum, their failure to grow at other than body temperature, and the lack of convincing evidence that the disease was contagious. These facts suggested that the infection arose within the individual. The prevailing location of the diseases about the jaw or neck pointed to the mouth as the sources of infection. In addition, the history of much trouble with the teeth preceding the infection was conspicuous in two of the author's cases of actinomycosis. Following this line of thought, Lord made careful microscopic, cultural, and biological examinations of the contents of carious teeth removed in 16 examined cases. In all 11 cases by cover slip preparations, Gram staining filaments mixed with other bacteria were found. Serial sections studied in 5 cases were positive. The organisms were present in such numbers as to suggest that they play a fundamental part in dental caries. The cultural experiments were not yet completed. Following the intraperitoneal inoculation of guinea-pigs, omental tumors histologically identical with actinomycotic tissue and containing typical club-bearing actinomyces granules have been produced in 3 of 5 animals. In summary, Israel states that the constancy with which actinomyces are present in carious teeth suggests that, under proper conditions of seed and soil, people with carious teeth are liable to develop actinomycosis. The organisms may invade neighboring tissues or find lodgement in more remote regions by way of the respiratory tract or alimentary canal. Local injury is an important predisposing factor.

Peristalsis of the Colon.—STIERLIN (*Ztschr. f. klin. Med.*, 1910, lxx, 376) finds that after the ingestion of bismuth the first shadow can be detected in the cecum in two to three hours, in the transverse colon in four hours, in the sigmoid flexure in six hours. Six to eight hours after the meal, the small intestine no longer casts a shadow on the Röntgen screen. This bismuth remains at the cecum and the colon ascendens longer than at any other point. Here the segmentation, so well seen in the transverse and descending colon, is not clear and the peristalsis can rarely, as Holzknecht has emphasized (*Münch. med. Woch.*, 1909) definitely be seen. This agrees with the occurrence of anti-peristalsis in this portion of the intestine, which has been demonstrated in animals by Cannon, tending to retain the intestinal contents at this point. At the splenic flexure the acuteness of the bend mechanically retards the intestinal content. As soon as the splenic flexure is passed, the descent to the sigmoid is unimpeded and rapid. The time taken by food to traverse the intestine varies between rather wide limits in normal individuals.

Echinococcus Serum Reaction in Tape Worm Hosts.—Since GHEDINI (*Gaz. d. Osp.*, 1907, No. 153) first introduced the complement absorption test for echinococcus, numerous authors have confirmed its value and

have shown that not only a positive but also a negative test could be relied upon with considerable certainty. Not every cyst fluid is satisfactory for antigen, however, that from the sheep being better than that from man. CHAUFFARD and VINCENT (*Gaz. d. hôp. de Paris*, 1910, lxxxiii 343) report a case in which complement fixation appeared only after the rupture of a cyst into a bronchus. Weinberg has later reported 3 cases in which a positive reaction only appeared after puncture or operation. [It is not impossible that, by using as antigen an alcoholic extract of cyst membrane, as advised by PARVU (*Bull. et Mém. Soc. méd. d. hôp de Paris*, 3^{me} s., 1910, xxvii, 371 and 429), some of these negative results might be avoided. A more serious objection is that of K. MEYER (*Berl. klin. Woch.*, 1910, xlvii, 1316), who, after finding that he could obtain complement fixation in the blood of 30 per cent. of hosts of *Tænia saginata* by using extracts of the worm as antigen, found also that *echinococcus* cases gave less strong but definite reactions to *Tænia saginata* antigen; and that, vice versa, patients with *Tænia saginata* gave positive reactions with *echinococcus* antigen.—W. S. T.]

Apparent Proof that Cammidge's Reaction is not Specific.—WHIPPLE and KING (*Johns Hopkins Hosp. Bull.*, 1910, xxi, 196) produced acute pancreatitis in dogs by the injection of 4 or 5 c.c. of pig's bile into the large pancreatic duct. All the animals with acute hemorrhagic pancreatitis gave a positive Cammidge test "C" in the urine with one exception; the crystals obtained corresponded in morphology and solubility to those described by Cammidge. Animals poisoned with chloroform showing an extensive necrosis of the liver, as a rule, gave a positive Cammidge reaction. The necrosis of the liver cells was held responsible. Two animals with bronchopneumonia gave a positive reaction. A piece of dog's pneumonic lung was hydrolized with 5 per cent. sulphuric acid for two hours, neutralized with barium hydroxide, and the clear filtrate injected into the peritoneum of a dog whose urine was previously negative. A beautiful Cammidge test developed and persisted one week. Operation then showed a normal peritoneum, pancreatic, liver, spleen, and kidney tissue. Human pneumonic lung, treated in the same way, in itself showed the reaction as well as producing it when injected intraperitoneally in a dog. Some perfectly normal female dogs, one after parturition, and some recovering from operations not involving the pancreas, gave the reaction. Whipple and King conclude that the Cammidge reaction is not specific for acute or chronic changes of the pancreas. The disintegration of any cells in the body may give the reaction, or even artificial hydrolysis of any animal tissue may give substances which will appear in the urine and give the characteristic crystals. It is possible that the disintegration of the polymorphonuclear leukocytes is an important factor in the production of this unknown substance.

The Gas Content and Viscosity of the Blood.—DETERMANN and WEIL (*Ztschr. f. klin. Med.*, 1910, lxx, 468) contrast the viscosity of blood taken before and after the production of venous stasis with the CO₂ and O₂ content. That CO₂ accumulation raises the viscosity was shown by A. V. Koranyi and Bence. This is in part due to swelling of the corpuscles in venous blood (Limbeck), but not entirely, for Adam

found a rise of viscosity in laked blood when treated with CO_2 . The Determann viscosimeter was employed. The CO_2 and O_2 determinations were made by the Bancroft-Haldane method. The blood to be examined was taken from a vein without any stasis having been produced, and again, after periods of stasis lasting up to ten minutes. The viscosity was found to depend first upon the number of corpuscles. Variations from this parallelism were caused chiefly by variations in the gas content. Other factors played so small a part that, knowing the number of corpuscles, the viscosity estimation is a simple means of getting a rough idea of the gas content of blood.

The Cutaneous Tricophytin Reaction.—AMBERG (*Jour. Exper. Med.*, 1910, xii, 435) vaccinated 131 cases with tricophytin after the method of v. Pirquet. Of 13 cases with a history of tricophytosis, 9 gave a positive reaction and 4 were negative. Four cases without a history of infection were positive. Parallel vaccinations were made with tuberculin and bouillon treated exactly like the tuberculin but without any bacteria. The bouillon reactions gave uniformly negative results. The tuberculin vaccinations did not give any results not noted before. Amberg concludes that there is a far-reaching analogy between the cutaneous tricophytin reaction and the cutaneous tuberculin reaction. Both indicate that the organism is the seat of a definite infection or that it has passed through such an infection. Both may persist for a long time after the active disease has come to rest, indicating that the infection has left the organism in a state of altered reactivity—allergy. Since the reaction persists for a long time after the infection has passed, the negative reaction may be of greater value than the positive, excluding the existence of a specific infection.

Demonstration of Tubercle Bacilli.—Simultaneously from Copenhagen and Berlin appear the communications of JORGENSEN (*Ztschr. f. Hyg. u. Infektionskr.*, 1910, lxxvi, 315) and HERZFELD (*Ztschr. f. Hyg. u. Infektionskr.*, 1910, lxxvi, 336) contrasting the digestion-sedimentation methods for finding tubercle bacilli in sputum. Both agree that the so-called Doppel method of Ellermann-Erlandsen surpasses all the other methods tried—including the antiformin, the ligroin, the auto-digestion and their better known modifications. The Ellermann-Erlandsen technique is as follows: (1) The sputum, in a glass cylinder, is well shaken with one-half its volume of 0.6 per cent. Na_2CO_3 solution, and then put in the incubator for twenty-four hours. (2) Pour off supernatant fluid, centrifuge the sediment, and pour off the remaining fluid. (3) To the fluid sediment add 2 to 4 volumes of 0.25 per cent. NaOH and heat to boiling while stirring. (4) Centrifuge and make smears from this sediment. Two to fifteen times as many bacilli were found by this means as by the antiformin method.

The Etiology of Pellagra.—RAUBITSCHER (*Wien. klin. Woch.*, 1910, xxii, 963) examined spoiled corn from districts where pellagra is common, without result. Extracts from the meal or from bread made with it were non-toxic. Neither fungi nor bacteria, pathogenic in themselves, and capable of producing toxic substances in corn, could be isolated. The serum of pellagrins showed neither complement fixation nor pre-

cipitin reaction with corn meal extracts. Patients who had been kept for a considerable time upon a corn diet showed no reaction to subcutaneous injection of corn extracts. Guinea-pigs previously injected with pellagra serum were not found to be in any way sensitized toward corn. The stools of pellagra cases showed nothing typical to bacteriological examination. Cultures, taken at autopsy, were negative. (Of amœbæ there is no mention.) Fagopyrismus (see Smith, *Johns Hopkins Hosp. Bull.*, 1909, xx, 153) is a condition produced in buckwheat-fed animals by exposure to sunlight. Loss of hair, emaciation, and paralytic symptoms develop in white or partly white animals; the dark-coated escape. Sunlight alone or the buckwheat diet alone does not produce the disease. The toxic substance in the buckwheat is alcohol soluble—a lipoid. Struck by the similarity of this intoxication to certain features of pellagra, Raubitschek placed white and colored animals side by side in a series of cages exposed to sunlight. Control cages were kept in the shade. The animals were fed upon good corn, spoiled corn, rice, and mixed diet. The group fed upon mixed diet were unaffected. Of those upon corn and rice diets, the white mice exposed to sunlight showed emaciation, ataxic movements, paralytic symptoms, and death in one to three weeks. The dark animals (half breeds) alone remained alive. Animals already beginning to show symptoms recovered if placed in the dark without changing the diet. Raubitschek believes that pellagra is due not to a toxic substance in corn itself, but to the production, by the action of sunlight on the skin of those living largely on corn, of a substance which, in addition to producing local symptoms in the skin itself, has a general toxic action upon the whole organism.

Leprosy Inoculation in Animals.—KEDROWSKI (*Ztschr. f. Hyg. u. Infektionskr.*, 1910, lxi, 1) reports the inoculation of rabbits and white mice with *Bacillus lepræ*. He found that in culture this bacillus assumed irregular forms; so that it probably belongs, with the tubercle and diphtheria bacilli, in the streptothrix or actinomyces group. Both in culture and in the body of man or laboratory animals it frequently loses its acid-fast quality. This is not, as Unna believes, an indication of death in the bacilli. In artificial cultures, diphtheria-like shapes are common; branched forms occur, but are rare. Cultures seldom retain their acid-fast quality, but usually regain it on inoculation into animals. In rabbits, inoculation into the lymphatics produces a picture which can hardly be differentiated from experimental tuberculosis. Intravenous injection leads to the formation of nodes made up of cells whose protoplasm is filled with bacilli. Such nodes are scattered throughout the internal organs. In white mice, nodules of large, granular, sometimes vacuolized cells filled with countless bacilli closely pressed together are produced. Kedrowski completely agrees with and emphasizes Danielsson's view of the extremely close relationship between leprosy and tuberculosis. The best inoculation results are to be obtained with mice and rats, animals in which leprosy, or a very similar disease, occurs spontaneously.

SURGERY.

UNDER THE CHARGE OF

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Intestinal Occlusion and Intestinal Paralysis Including Peritonitis.—

THIEMANN (*Archiv f. klin. Chir.*, 1910, xcii, 567) says that ileus from inspissated fecal masses occurs in chronic constipation with general atrophy and weakness of the musculature (for example, in spinal cord paralysis), and in anomalies of length and width of individual portions of the intestine. A rare occurrence is the formation of multiple fecal calculi in the large intestine, with resulting diverticula formation and perforation. A comparison of the statistics of gallstone ileus of earlier and later years shows a considerable diminution in the mortality. Foreign bodies entering by the mouth rarely cause complete obstruction, since those which pass the œsophagus usually pass through the intestine. Their chief danger comes from perforation, which occurs most frequently in the ascending portion of the duodenum. Characteristic of chronic inflammation resulting from perforated foreign bodies, is a peculiar, hard swelling of the surrounding tissues, which can secondarily obstruct the intestine. Benign intestinal tumors as such rarely cause ileus, but more frequently invagination. The mortality after operation for stenosis of the large intestine is high and is especially the result of the development of acute ileus. Carcinoma of the ampulla of the rectum rarely causes complete obstruction, but is usually inoperable. Any inflammation in the abdomen can cause ileus from adhesions, which can lead to disturbances a long time after healing. Peritoneal tuberculosis with effusion is favorably influenced by opening the abdomen. Circumscribed abscesses, forming tumors, as well as stenosing tuberculosis, are improved. Complete stenosis and ileus are very rare. More frequent is the occlusion from adhesions and bands due to a primary tuberculosis of the mesenteric nodes, especially when in the stage of caseation and suppuration. In chronic mesenteric peritonitis, the separation of all adhesions is fruitless and often dangerous, since recurrence is likely to follow in an aggravated form. In the cases of appendicitis in a hernial sac with symptoms of strangulation, the former was always the primary disease. Especially severe are the symptoms of torsion of epiploic appendages in comparison to the size of the object. Volvulus is most frequent in the large intestine, especially at the sigmoid flexure. It is favored by abnormal length of the flexure as well as by chronic inflammation of its mesentery, which approximates its limbs toward each other, thus interfering with the fecal current in the end of the loop. To avoid recurrence, an anastomosis between the

limbs at the ends is advised. In general, in perforated gastric ulcer, it will suffice to close the opening by suture and to cover it over by omentum. Especially to be avoided is the excision of an ulcer of the lesser curvature, since this tends to an excessive loss of substance, and to the necessity of an extensive transverse resection of the wall of the stomach. When the ulcer is situated at the pylorus a gastro-enterostomy often cannot be avoided. After the removal of escaped material the peritoneal cavity should be closed. A perforation which has lasted more than twenty-four hours may get well by this treatment. Perforation of a gangrenous gall-bladder is very unfavorable. Of all means for the prevention of postoperative adhesions, the most effective is the early stimulation of peristalsis by the employment of enteroclysis with saline solution.

Cystoscopic Examination in Renal Tuberculosis.—BARRINGER (*Annals of Surgery*, 1910, lii, 238) says that by means of the cystoscopic examination we can almost always tell which kidney is affected in renal tuberculosis. The exception to this is when the tuberculous process is shut off from the kidney pelvis or when the kidney excretes nothing at all through the ureter. The extent of the lesion cannot be accurately determined by the cystoscopic examination, which must in all cases be supplemented by ureteral catheterization or urinary separation. Aside from its rigidity, the most typical changes in the ureteral orifices are, (a) tubercles around the orifice; (b) red granulations; (c) an enlarged, thickened, and ulcerated orifice. A ureter which looks normal and which is contracting and excreting urine, indicates in the large majority of cases a kidney which is excreting normal urine as regards pus and tubercle bacilli, and has a normal functional capacity. In some cases the diagnosis of tuberculosis can be made by means of the cystoscopy alone. This is of considerable value when tubercle bacilli are not found in the urine.

Duodenal Ulcer and its Surgical Treatment.—ZESAS (*Deut. Ztschr. f. Chir.*, 1910, cv, 494) reports three cases of duodenal ulcer operated on by Wilms, who explored the ulcer with the finger inside the duodenum before treating the ulcer itself by folding it in with sutures. The stomach was brought into the abdominal wound, a purse-string suture was placed in the anterior wall of the stomach, an opening made within the suture, the finger introduced through the opening, and the purse string drawn tightly around the finger. The latter was then passed through the pylorus into the duodenum, where in each case it palpated the ulcer close to the pylorus. After the withdrawal of the finger the opening in the stomach wall was closed by the purse-string suture. The ulcer was then folded inward and the wall of the duodenum on both sides of it approximated by suture. In the second case a gastro-enterostomy was performed. All three patients recovered. The method is simple and permits direct treatment of the ulcer, but does not apply to those ulcers so low in the duodenum that they can not be reached by the palpating finger introduced into the stomach. These, however, represent the least frequent of the duodenal ulcers. In small, frequently repeated hemorrhages, radical operation, either by the folding in of the ulcer according to the Wilm's method or its excision, is indicated. The

treatment of greater hemorrhages shows a divergence of opinion. Savariaud recommends in such cases a ligation of the pancreatoduodenal artery. Gastro-enterostomy has been employed successfully in these as in the cases with smaller hemorrhages. In one of Jaboulay's cases, however, the hemorrhage persisted after the gastro-enterostomy, and the patient died. Moynihan regards it as the ideal method in duodenal hemorrhages. Other observations tend to show its insecurity in the treatment of the hemorrhage or the ulcer itself. Perforation of the ulcer is more frequent than hemorrhage. The mortality is high and the higher the longer the operation is delayed after the occurrence of the perforation. Retroperitoneal abscesses must be opened, posteriorly through the lumbar muscles or from the side, and drained. The prognosis is not so bad as in subphrenic abscesses, which, according to Lieblein, prove fatal whether operated on or not. When there is a duodenal stenosis gastro-enterostomy is the normal operation to be performed. The rule should be that all affections of the stomach threatening the life of the patient, by deficient nourishment, continuous disturbances, hemorrhages, or perforation, call for operation.

Wounds of the Heart.—ISELIN (*Deut. Ztschr. f. Chir.*, 1910, cv, 572) reports a case of successful operation for gunshot wound of the heart, in a girl, aged twenty years, who was found unconscious after an attempt at suicide, one hour after which she was brought to the clinic. On the left side of the chest, just internal to the mammary line, in the fourth interspace, was found the wound of entrance. The heart distress was not marked, the pulse was regular, strong, and the rate was about 120. The diagnosis was made of a wound of the chest with a suspicion of a wound of the heart and lungs. Iselin saw her first one and three-quarters hours after the wound had been inflicted. The breathing was then labored and the pulse could not be felt. Operation was performed at once. The wound of entrance which passed through the mammary gland was excised, and an incision was made along the fourth intercostal space. The fifth rib was divided in its bony portion as well as its cartilage near the sternum. On retracting the sides of the wound, the pericardium and pleura were exposed. A strong stream of blood escaped from the upper part of the pericardial sac, which was tensely filled. After opening it widely there was seen in the wall of the anterior ventricle, nearer its base than its apex, a small irregular hole, out of which spurted blood. The heart was brought forward and held by the hand. The wound of entrance and the somewhat larger wound of exit in the posterior wall at the same level were easily closed with catgut sutures, which did not penetrate the whole muscle. Blood continued to flow from both wounds. The radial pulse, which upon the opening of the pericardium and the escape of much fluid blood became again palpable, again disappeared during the introduction of the sutures into the heart. The external wound was closed by pinching and the heart allowed to recover while the gloves were being exchanged. In a few minutes the pulse could be felt. The heart sutures were now holding. The pleura contained fluid and clotted blood, but the hemorrhage did not threaten the patient's life. By lengthening the incision to the anterior axillary line, the collapsed lung was exposed and the wound in it sutured without bringing it forward. The missile was not

found. After wiping out the chest cavity the opening in the pericardium was closed to a small opening below, which communicated with the pleura and drained in that direction. The external opening in the pleura with the muscle layer was closed as tightly as possible with sutures. A large rubber drainage tube surrounded by iodoform gauze was introduced into the superficial wound and directed posteriorly. The operation lasted about three-quarters of an hour. During the first days after the operation the exhaustion was marked, while later the lung disturbances were most pronounced. Except for her demands for water, she slept almost all of the time. The wound healed without trouble and in fourteen days had cicatrized. It is now well concealed under the overhanging breast.

Autoplastic Transplantation of Bone. JANEWAY (*Annals of Surgery*, 1910, lii, 217) says that the available methods of filling in deficiencies in bone have never been popular. A woman, now aged forty-two years, twelve years ago had removed from the left arm a tumor about 5 inches long which was found attached to the anterior surface of the ulna by a flattened pedicle. The point of attachment in the ulna was curretted. Recurrence was noticed in one year, the growth now being about 2 inches long. This was extirpated, and one year and three months later another recurrence was excised under local anesthesia. Again within four months a fourth recurrence was noticed, but the patient neglected treatment until one year and three months after the preceding operation. Through an incision along the posterior border of the ulna and dividing the joined aponeurosis of the extensor and flexor carpi ulnaris, the tumor was removed by resecting a portion of the ulna, five and one-half inches long. A fragment of the same length, three-eighths of an inch wide and one-eighth of an inch thick was now chiselled off from the crest of the tibia, together with its adherent periosteum. This was placed between the two extremities of the ulna remaining, and fastened in place with silver wire. The periosteum of the implanted fragment was also sutured to the periosteum of the remaining portions of the ulna. The wound was now closed with the exception of a small drain at each end. After the first twenty-four hours the drains were removed and a plaster splint applied. Thereafter the wound was dressed on the fourth, seventh, and tenth days, at the end of which time it was healed throughout. At no time was there any elevation of temperature. In two months the patient could freely use her arm for washing clothes at a tub. Microscopic examination showed that the growth was a chondrosarcoma. Radiograms, taken four and fourteen months after the operation, demonstrate the increase in thickness of the implanted fragment and the formation of callus at the upper end by the implanted periosteum, and at the lower end the direct union of the implanted piece with the ulna. If we inquire into the nature of the histological processes which have taken place, we must assume, as the result of the conclusions of research work upon implanted bone and periosteum, that the implanted bone itself had died, but that the periosteum and marrow lived and replaced the old bone with the new. The case illustrates the peculiar adaptability of the tibia (its accessibility and its strength and thickness) to the function of furnishing a suitable bony graft. The radiograms demonstrate

that such an autoplasmic graft firmly unites to the fragments between which it is placed and eventually becomes transformed into a thicker piece of living bone, its thickness being determined by the demands for strength required in its new position. Finally, in the case cited, the smooth and rapid healing is an indication that the autoplasmic method of remedying bony defects is the procedure of choice and is deserving of wider application than it at present is receiving.

Extirpation of the Thymus Gland and its Results.—KLOSE (*Archiv f. klin. Chir.*, 1910, xcii, 1125) reports that his chief, Rehn, has, up to the present time, operated on 21 children for thymus stenosis, of which, 16 were completely cured and 2 improved. Three died because the operation was too long delayed. We know nothing of the physiological importance of this organ. For the past three years Klose has been carrying out numerous experiments on young dogs. The success of the experiments was dependent upon the surgical technique that would preserve life and remove minutely the whole organ. He concluded that the thymus is a vital organ, which in early childhood should never be entirely removed. The symptoms which follow its removal are the results of an acid intoxication, probably an acid nuclei intoxication and diminution of phosphates. In the foreground stand the bone and brain disturbances. They occur during and after the involution phase. Partial removal at the height of its anatomical existence and total removal in the involution stage show no permanent disturbances. If, however, the spleen is removed secondarily, the dog will die. The substituting organ of the thymus is the spleen. The loss of the thymus cannot be compensated for by the administration of thymus preparations. The therapeutic indication is to increase the alkalies administered. Thymus preparations do damage by increasing the acids of the body. The rational surgical therapy consists in autoplasty.

The Treatment of Exstrophy of the Bladder by the Conversion of the Isolated Cecum into the Bladder and the Appendix into the Urethra.—MAKKAS (*Zentrbl. f. Chir.*, 1910, xxxvii, 1073) says that Maydl's operation of transplanting the ureters into the colon has become the choice for the treatment of exstrophy of the bladder. Still its mortality is high, fistula formation not rare, and continence of urine sometimes wanting. The greatest danger is that of ascending infection to the kidney, which may intervene a long time after the operation. Various modifications have been offered to overcome this danger. Makkas had conceived of using the isolated cecum as the bladder and the appendix as the urethra, but while he was waiting for an opportunity to attempt the operation, Verhoogen did it on a patient suffering from carcinoma of the bladder, which was extirpated, but the patient died. Makkas did the operation May 10, 1910, on a girl, aged twelve years, with exstrophy of the bladder, atresia of the vagina, an anus situated more anteriorly than usual, and a weak sphincter. A 12 cm. incision was made through the right rectus, the cecum isolated completely and both divided ends were closed, and the cecum displaced easily to the median line. The ileum was also divided and both ends closed. The closed ileum was then anastomosed to the transverse colon side to side. The appendix, about 7 cm. long, was passed through a small opening in the abdominal wall just below the operative incision, the distal end

removed and its mucosa sutured to the skin. The large incision was then closed by three layers of sutures. From the tenth day on the cecum was irrigated through the appendix by means of a Nélaton catheter, the irrigating fluid always bringing out some mucus. On June 18, 1910, the second operation was performed. An incision was made around the ectopic bladder, which was then separated from its bed. The ureters were isolated for about 4 or 5 cm., including as much as possible of the periureteral tissue to preserve its nourishment. A median incision was then made in the abdominal wall. The cecum now lay near the median line adherent to the anterior abdominal wall. It was opened near its lower pole and a piece of the bladder wall about the size of a five mark piece and carrying the ureteral openings was implanted into the opening in the cecum and fixed there by sutures in two layers. The abdominal wound was closed and a tampon placed in the lower angle. A Nélaton catheter was retained in the new bladder and urethra. There were no wound complications. The urine flowed freely through the catheter and the new bladder was irrigated several times daily. On the eighth day the permanent catheter was closed by a stopper and the bladder emptied every two or three hours. The capacity was at first 100 c.c., but increased considerably in the next few days. Four weeks after operation the patient was out of bed and free of fever, but still carrying the catheter. It was necessary to empty the bladder every three or four hours during the day and not at all at night. Its capacity was now 325 c.c. When the bladder is full the urine cannot escape without the introduction of the catheter. The daily quantity of urine excreted is 1000 to 1200 c.c., and it is mixed with mucus but free of albumin.

Peritonitis following Perforative Appendicitis.—KRON (*Archiv f. klin. Chir.*, 1910, xcii, 1105) says that although twenty-five years have passed since the first operation for peritonitis, opinions still vary concerning the best treatment. Unity in the terminology of peritonitis is very desirable, since many authors designate different processes in the abdominal cavity by the same name (for example, diffuse peritonitis and general peritonitis), and thus render statistics on the subject less valuable. From infection of the peritoneal cavity after a perforation of an inflamed appendix, we usually find a diffuse pelvic peritonitis, a diffuse unilateral peritonitis, a unilocular or a multilocular peritonitis. The early symptoms are such as to cause delay in reaching a conclusion. Until the present the so-called "muscular defence" is the only generally recognized early symptom. The appearance of the tongue, in connection with the general condition of the patient, will give an important suggestion for the early recognition of the disease. So far as the operative treatment is concerned, experiments on animals and the statistics of many authors with which those of Kron closely agree, speak for the dry method of treatment rather than for irrigation. The dry treatment consists essentially of complete removal of the fluid exudate, removal of the focus of infection, and the prevention of the reaccumulation of the exudate. By the former, much time is saved and the resistance of the organism spared. The success depends upon careful and skilful after-treatment. In the evening a subcutaneous injection of 600 c.c. of saline solution is given, and during the first few days 5 to 10 liters are given. Fowler's position is strongly recommended.

THERAPEUTICS.

 UNDER THE CHARGE OF

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The Results of Serum Therapy in Diphtheria Compared with Results before the Use of Antitoxin.—TIMMER (*Berl. klin. Woch.*, 1910, xlvii, 1313) gives some interesting statistics regarding the effects of diphtheria antitoxin in the treatment of diphtheria. He divides the cases studied into two classes. The first class of cases comprise those treated before the use of antitoxin, and the second class includes those treated with antitoxin. In 1087 cases of diphtheria belonging to the first class, the mortality was 37.8 per cent., while in 4226 cases belonging to the second class the mortality was only 9.7 per cent. He then points out that a much smaller number of those patients treated with antitoxin require such operations as tracheotomy or intubation to relieve symptoms of laryngeal stenosis. Thus, of 1087 patients admitted before the use of antitoxin, 605 required such operations, which expressed in percentage equals 55.5. In comparing this with the antitoxin period he found that of 4226 cases, only 1231 required operations, a percentage of 29. Furthermore, the mortality in the cases operated upon is much lower with the serum treatment than before the days of antitoxin. Thus, for instance, in the 605 cases operated upon before antitoxin, 334 died, a percentage of 55.2, while of 1231 cases operated upon with serum treatment, only 330 died, or 26.8 per cent. Timmer says that this diminution is not dependent upon a less virulent form of diphtheria, but the patients are operated upon in much better general condition. The fact that fewer cases occur that require operation he thinks is due to the more extensive use of antitoxin. He has also observed that the symptoms of stenosis disappear in many cases after serum injections, and thus an operation is avoided. Timmer notes that the mortality of diphtheria varies according to the age of the patient, the mortality being very high during the first two years of life. He found that the mortality fell during the period when antitoxin was used from 90 and 70 per cent. to 64.9 and 40.6 per cent, while in older children the fall was still greater, that is, from 55.2 per cent. to 26.8 per cent. Timmer includes in his article tables showing the mortality during the periods before and after the use of antitoxin in several hospitals that seems conclusive in showing the beneficial effects of the serum treatment of diphtheria.

Pantopon.—SAHLI (*Münch. med. Woch.*, 1910, lvii, 1326) says that pantopon has proved to be a most useful remedy after a long-continued trial. Pantopon is a derivative of opium, containing all the alkaloids freed from resins and other noxious substances. It is freely soluble in water, and so may be utilized for subcutaneous use. For subcutaneous use Sahli recommends a 2 per cent. solution of pantopon in 75 parts of water and 25 parts of glycerin. This solution remains stable and

need not be sterilized before using. The ordinary dose of this solution is 1 c.c. The indications for its use are the same as for the other opium derivatives, but similar effects are obtained with correspondingly smaller doses. Sahli states that untoward effects such as vomiting, constipation, and excitability are much less frequent with pantopon than with morphine.

The Autolysis of Pneumococci and the Effect of the Injection of Autolyzed Pneumococci.—ROSENOW (*Jour. Amer. Med. Assoc.*, 1910, liv, 1943) states that pneumococci when suspended in sodium chloride solution disintegrate and become Gram-negative. This process has been proved to be a true autolysis and not due to the action of sodium chloride in the solution, or to the solubility of the protoplasm of the pneumococcus in water. He says that further studies of the soluble substances and the autolyzed pneumococci are in progress, but that the following preliminary statements can be made. It seems that by means of autolysis it is possible to separate, at least to a large degree, the toxic from the non-toxic or antigenic parts of the pneumococcus. The part which goes into solution is the toxic portion. It causes peritonitis and leukocytosis in animals; marked local reaction, leukocytosis, and some fever when injected subcutaneously in man. The opsonic curve shows only slight rise. It is impossible to immunize animals to any marked degree by repeated injections. Intravenous injections into rabbits may prove fatal. The injection of the non-toxic and, as it appears, the antigenic portion, the autolyzed pneumococci, on the other hand, causes practically no local reaction, only slight increase in the number of leukocytes, but a marked increase in the immunity curve as measured by the specific increase in pneumococco-opsonin. The usual negative phase is absent. From a number of tests it appears clear that the simultaneous injection of the toxic part interferes to a marked degree with the immunity curve produced by the non-toxic portion. The author tried the injection of autolyzed pneumococci in 25 patients with lobar pneumonia, and believes that it is a valuable aid in the treatment of this disease. In 2 cases of pneumococcic empyema, he also states, it seemed to have a decided beneficial effect, but more tests will be necessary to prove this point.

The Treatment of Gastric and Duodenal Ulcer.—SPRIGGS (*British Med. Jour.*, 1910, 2577, 1216) concludes from a comparison of his series of cases with a similar number of cases treated by other methods: (1) That the Lenhart method of treatment is not more dangerous than treatment by nutrient and saline enemas, followed by a graduated milk diet. In these particular cases the recurrence of hemorrhage was less frequent and there were no deaths. (2) That the pain suffered by the patient in the course of treatment is less on the Lenhart diet. (3) The diet gives far more nourishment than can be introduced into the body by nutrient enemas, and is, therefore, more desirable in patients who have frequently been for a long time in a state of semi-starvation, or have suffered a loss of blood or both. (4) That in cases treated by this method rectal injections may be entirely avoided. This is an advantage in a hospital, and a still greater advantage in treating cases at their homes, where rectal injections are not only regarded as extremely un-

pleasant, but are seldom efficiently administered. Gerhardt used the Leube and the Lenhartz methods, and obtained good results with each. This is also Sprigg's experience. The choice may then turn upon convenience, and there is no doubt that the latter method is more convenient. Whenever the Lenhartz method is discussed the objection is put forward that it does not seem wise to put food into the stomach immediately after a hemorrhage. The fact is that such patients do well, and recurrent hemorrhages are less frequent than in patients treated by other methods. Spriggs says that the treatment of duodenal ulcer should be the same as that for gastric ulcer. Patients with duodenal ulcer do well upon a Lenhartz diet. He often combines with it $\frac{1}{2}$ ounce of olive or almond oil three times a day, following the method introduced by Cohnheim and by Walko, and advocated by Hertz. On this plan $\frac{1}{2}$ ounce of oil is given every three hours and increased to 1 or 2 ounces. Nothing else is given except water for thirst, until there is no blood in the stools. Cream is then given and the foods of the Lenhartz diet are added gradually, but not the rice. The oil is now reduced to 1 ounce before each meal. He has tried this method thoroughly, and recommends it for patients who will endure it. To others it is exceedingly distasteful and fails on that account. Whenever retching or vomiting is caused the treatment should be altered. If the patient does not respond to one or other form of dietetic treatment, the possibility of the symptoms being due to gallstones must be carefully reconsidered.

Muscular Rheumatism.—SCHMIDT (*Med. Klinik*, 1910, vi, 131) believes that the pain of muscular rheumatism is neuralgic in character, and he suggests treating it with injections of physiological salt solution at the painful points. The injection of 5 or 10 c.c. of salt solution into the muscle at the most painful point will frequently relieve the pain, though, of course, it has no effect upon the cause of the pain. In protracted or very acute cases Schmidt advises lumbar puncture which may be followed by spinal anesthesia if necessary. Schmidt has seen lumbar puncture alone cure an obstinate case of myalgia and thinks that a trial is justified in the very severe cases.

The Treatment of Chorea with Large Doses of Arsenic.—HASSIN and HERSHFIELD (*Med. Record*, 1910, lxxviii, 15) say that arsenic in the form of Fowler's solution remains the most effective method of treatment of chorea, provided it is given in large doses. However, the possibilities of grave complications on the part of the gastrointestinal tract and nervous system renders this method of treatment inapplicable in many cases. Comby maintains that arsenous acid well diluted is much better borne than Fowler's solution. He takes 10 c.c. of a 1 to 1000 solution of arsenous acid, dilutes it with six tablespoonfuls of water and gives one tablespoonful of this mixture in milk every two hours. This is roughly equivalent to $\frac{1}{8}$ of a grain of arsenous acid. Starting with this initial dose, he increases the amount of the arsenous acid solution by 5 c.c. each day until at the end of a week 40 c.c. are given. Then beginning with the eighth day, he progressively diminishes the daily dose by 5 c.c.; so that at the end of the second week the dose is the same as the initial dose. Thus the entire treatment takes two weeks during which time the patient takes about six grains of arsenous acid. There

have been serious complications resulting from these huge doses of arsenic, and the authors made use of a modification of Comby's method as advocated by Filaloo. Filaloo, for a child of from four to six years of age, begins with a daily initial dose of 2 c.c. of a 1 to 1000 solution of arsenous acid, increasing the amount by 2 c.c. daily for seven days. He then diminishes the daily dose by 2 c.c., so that the entire course of treatment is over a period of two weeks. For older children the initial dose is 4 c.c., which is increased daily by 4 c.c., and after a week is diminished by the same amount. Hassin and Herschfield report excellent results with the use of this method and claim that large doses of arsenic are much better borne by this method than when Fowler's solution is used. They also think that the bye-effects of arsenical treatment can be greatly mitigated by using arsenous acid instead of Fowler's solution.

The Treatment of the Hookworm Disease.—LINDEMAN (*Jour. Amer. Med. Assoc.*, 1910, liv, 1765) gives the following treatment for hookworm disease: The patient should have nothing to eat from noon of the day previous to the administration day of the thymol. On this day and the day following, fat of any kind, milk, cream, butter, bacon, etc., should be avoided. Whiskey, beer, wine, and oils are absolutely interdicted, as all these can dissolve thymol. Early in the evening of the first day sufficient Epsom salts should be given for efficient purgation. It is important that the bowels should be well moved. Early the next day the dose of thymol decided on should be divided into two parts and given one hour apart. It is best administered in cachets triturated with equal parts of milk-sugar, and before using, the cachets should be well softened in water until they are of the consistency of a raw oyster. It is best to put the patient to bed, on the right side. The thymol should be retained for from two to five hours, unless distress or symptoms of intoxication occur. Epsom salts should then be used for flushing the bowels and expelling the drug. The following dosage as outlined by the State Board of Health of Florida is considered safe to use: Under five years of age, up to 8 grains; from five to ten years of age, 8 to 15 grains; from ten to fifteen years of age, 15 to 30 grains; from fifteen to twenty years of age, 30 to 45 grains; from twenty to sixty years of age, 45 to 60 grains; over sixty years of age, 45 grains. In determining the size of the dose the apparent age and the real weight of the child should be considered. The nauseating effects of Epsom salt can be considerably lessened if dissolved in the smallest quantity of warm water possible and swallowed; this to be then followed by a large quantity of any mild fluid, even water. The mixing thus takes place in the stomach instead of in the glass. The patient may begin to eat after the bowels are well moved on this day. It is best that they should eat sparingly and avoid distress from engorgement. The same precautions should be observed on this day regarding fats, oils, alcohol, etc. Once the worm is eradicated, fresh air, sunshine, plenty of water, and proper food are the chief requirements for the treatment of the anemia of hookworm disease. Iron, arsenic, tonics, and ferruginous vegetables are indicated. The patient should be treated at intervals of one, two or three weeks until the stool is free from eggs or parasites. The more debilitated patients should be treated at longer intervals. Betanaphthol

is not so toxic to the parasite as thymol, but has a more toxic action on the kidneys. The anthelmintic properties of turpentine are less than those of thymol; besides turpentine is less desirable because of its ready absorption and liability to produce acute nephritis. Pressed thymol tablets should never be used.

PEDIATRICS.

UNDER THE CHARGE OF

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Effect on a Syphilitic Child of Injecting the Mother with Ehrlich's "606."
—KARL TAEGER (*Münch. med. Woch.*, 1910, lvii, 1725) reports a remarkable recovery from congenital syphilis by injecting the mother with Ehrlich's arsenical compound (dioxy-diamido-arseno-benzol). A woman pregnant at term exhibited mucous patches, condylomas, and many spirochetes. The child when born was extremely pale, weak, and sickly. It did not cry, but lay in an apathetic state and took the breast poorly. No characteristic signs of syphilis appeared until the eighth day, when numerous lesions of pemphigus appeared on the soles of the feet and at the same time syphilitic paronychia on both hands. These lesions tending to spread, the mother was injected in each buttock with 0.3 gram of Ehrlich's "606" in sterile water. On the third day the woman complained of pain, on the fourth day a reddish exanthem appeared on the buttocks, and on the fifth day headache developed. Three days after the injection the lesions began to fade rapidly and the spirochetes disappeared. The child showed increased spread of the lesions for two days following the mother's treatment. The third day it showed rapid clearing up of the symptoms, and by the fifth day the pemphigus and the paronychia had disappeared, the grayish pallor had given place to a healthy tint, the child was no longer apathetic, but cried lustily and took the breast greedily. Ten days later the child was well and still free from symptoms. An explanation of the production of this remarkable result is difficult to find. That the "606" compound was not transmitted to the child through the mother's milk was shown by the fact that this milk contained no trace of the arsenic. Ehrlich himself explains it by the theory that the sudden destruction of the spirochetes sets free a large amount of endotoxins which excite the production of antitoxins, and these latter are then transmitted through the mother's milk to the child with curative effect. However this may be, the sudden clearing up of the symptoms in the child did follow the use of the "606" on the mother, and this result may offer a new and improved method for treating syphilitic infants. Ehrlich especially warns against injecting his remedy directly into small infants, not from any toxic quality in the remedy itself but from the large amount of endotoxin liberated in the child's system from the destruction of the many spirochetes.

Venereal Disease in Children.—C. F. MARSHALL (*Brit. Jour. Child. Diseases*, 1910, vii, 385) discusses syphilis and gonorrhœa as seen in infants and children. Acquired syphilis is the form here considered, as simple chancre is exceedingly rare. Acquired syphilis exhibits a chancre which is small and usually situated on the face. An infant may be infected by wet nurses, kissing, playing with congenitally syphilitic children, and by contaminated spoons, nursing bottles, etc. The absence of characteristic congenital lesions and the contrast between the age of the child and the quality of the lesions will aid in differentiating acquired from congenital syphilis. Tertiary lesions are often impossible to distinguish, and the older the child the more difficult becomes the differentiation. Diagnosis is often important from a medicolegal standpoint. The relation of syphilis to tuberculosis is important. Fournier points out that syphilis predisposes to tuberculosis, especially the pulmonary type. A symbiosis of syphilis and tubercle may occur, usually in congenital syphilitics, which probably accounts for many of the glandular, chronic bone and joint affections formerly designated struma or scrofula. These conditions improve materially on mercurial treatment, especially the latter, and should be tested both by the Wassermann and the tuberculin methods. Gonorrhœa in female children appears usually as a vulvovaginitis, and occurs occasionally as an epidemic in schools and institutions for girls, the disease spreading from some infected person, or from towels, etc. In boys the disease takes the form of a urethritis, but may involve the nose and mouth. However contracted, this disease in children may take the same complications as occur in adults. Gonococcic arthritis and septicemia occur in both sexes. Kimball reports 8 cases of gonorrhœal pyemia in infants under three months old, exhibiting arthritis in 6 cases; 3 cases had gonorrhœal stomatitis. Northrup, Lucas, and Pollack report many cases of arthritis and peritonitis in children following gonorrhœal infection. Gonococcal septicemia may simulate closely enteric fever, but usually shows joint symptoms. The gonococcus is often found in the blood and in 50 per cent. of cases in the fluid from involved joints. The subacute form often simulates tuberculous joint conditions. Syphilitic joint affections, however, usually exhibit little pain and discomfort. Eyre, Butler, Whitehouse, and others found vaccine treatment in acute and chronic gonorrhœa better than the routine treatment. Besides local treatment with silver salts, etc., a preparation of lactic acid bacilli and also yeast in asparagin or cane sugar as a medium have proved of considerable value.

Intra-uterine Transmission of Malaria.—W. PIES (*Monatsschrift f. Kinderheilkunde*, 1910, ix, 51) states that reported cases of intra-uterine transmission of malaria are few, even in malarial districts. But even before the discovery of the plasmodium of malaria it was found that both premature and full term infants whose mothers suffered from malaria were born with the characteristic signs of malarial cachexia. Numbers of cases are reported by Monti, Playfair, and others, in which children at birth presented undoubted evidences of malaria. Moncorvo, in Rio de Janeiro, out of 5000 cases of malaria in children, reported 20 undoubted clinical cases of malaria in the newborn, although the plasmodium was not found in the placenta or foetal blood. Bal-

lantyne found the plasmodium in the blood of a mother and child suffering from intermittent fever on the first day of the puerperium. Holt reports a case in which the mother suffered from tertian malaria ten days before her confinement. Eighteen hours after the birth of the child it exhibited chilliness followed by a fever and perspiration, which was repeated on the following day, when a blood examination showed the malarial parasite in the child and the mother. Pies himself, reports the case of a child born in Germany, in January, 1910. The mother had an attack of malaria in May and August, 1909, which she contracted in Africa. When seven months pregnant, the mother suffered severe uterine pains, which subsided on rest in bed. Birth was normal and the child healthy until the thirtieth day, when it developed a yellowish pallor. Two days later it exhibited fever followed by profuse perspiration and a fall in temperature. This attack was repeated the following day, and an examination showed anemia and enlarged spleen and liver. The blood of the child taken during the paroxysm showed many tertian parasites, schizomycetes, and gametes, with characteristic changes in the red blood cells. The malarial attacks continued for six days, when they disappeared quickly under small doses of quinine. Professor Koeh, who studied the case, concluded from the blood picture that it could not have been a fresh infection. The mother showed no plasmodia, having previously been under quinine treatment. A number of authors claim that malaria cannot be transmitted to the child in utero by way of the placenta. Pies believes the malarial infection is carried direct to the child through the blood current (Gärtner and Sitzenfrey have shown the possibility of placental infection by tuberculosis). Pies believes that uterine contractions caused breaking of the villi, and this allowed the mother's blood to get directly into the circulation of the fœtus. He explains the length of time before the paroxysms appeared by a long incubation period, as proved by Koeh, Simms, and Warwick. The child was born in a community free from malaria and mosquitoes, and primary infection can be excluded. He believes this to be a case of intra-uterine transmission of malaria by a direct blood stream.

Hypothyroidism in Children.—W. STOELTZNER (*Jahrbuch f. Kinderheilkunde*, 1910, xxii, 149) deprecates the general unfamiliarity with infantile myxœdema, especially the rudimentary forms, which are often difficult of diagnosis and often overlooked, since the usual signs of myxœdema are slight. The frequency of the rudimentary form he places not far behind that of the fully developed infantile myxœdema. In a boy, aged six years, the only symptoms were a cessation of body growth dating from his second year, and a cast of feature which gave only a suggestion of the cretinoid. He was fairly bright mentally and attended school. On treatment with thyroid extract, the results were brilliant. Body growth recommenced and proceeded rapidly, and the entire physical and mental condition improved wonderfully, the features losing their cretinoid suggestion. The etiology of the thyroid changes behind this condition is obscure, but Stoeltzner reports two cases in which hypothyroidism began with an infectious disease. In one case a girl, aged two and one-half years, stopped growing during

a severe attack of measles, and developed large myxœdematous infiltrations beneath the skin, accompanied by mental dulness. In another case a girl, aged five years, during an attack of mumps, developed an acute enlargement of the thyroid gland, which disappeared in a short time. Immediately following this the body growth ceased, the hair became coarse and lusterless, and mental dulness developed. Thyroid extract was exhibited for a short time until the patient passed from observation. Five years later the child was found to be normal in every way and showed no signs of the disease. The mother stated that the child had remained in the myxœdematous state for two years after the first treatment, and had then suddenly begun to improve naturally and without medication. Stoeltzner can find no cases of traumatic hypothyroidism in literature, but himself reports a circumstantial case in a girl, aged nine years, with fully developed myxœdema, which had followed immediately on a deep lacerating wound of the neck directly over the site of the thyroid gland, occurring two years before. A deep scar an inch long marked the site of the wound. Small doses of thyroid gave marked improvement. Stoeltzner believes that the condition in children which is marked by excessive fatness, flabbiness, turgidity, and pallor, with enlarged tonsils and adenoids, and a dull phlegmatic mentality, is identical with hypothyroidism. In a child exhibiting this condition with rickets, thyroid extract cleared up the former condition nicely, but did not affect the latter. He believes good results will follow the use of thyroid extract in children with the above diathesis. He suggests the examination of such cases by the x-rays to determine whether a condition of bone development characteristic of hypothyroidism may not also be present.

OBSTETRICS.

UNDER THE CHARGE OF

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The Significance of Albuminoid Bodies in the Urine of Pregnant and Puerperal Women.—JAGEROOS (*Archivf. Gyn.*, xei, Heft 1, 1910) has made a thorough study of the significance of albuminoid bodies in the urine of pregnant and puerperal patients. He reviews the literature of the subject, and from his own studies and the review of the literature concludes that albuminuria is a normal phenomenon in pregnancy and in the puerperal period. The term "normal albuminuria" should be restricted to minute quantities of albumin found in perfectly healthy patients when the organism is in a condition of complete equilibrium. Albuminuria occurring during labor is a reasonable accompaniment of parturition; the quantity is greater than can be considered normal, and is often the greatest seen in any except a permanent pathological condition. The condition requires no especial and separate treatment, and

cannot be considered a permanent pathological lesion. The albuminuria of labor is differentiated from the other by the presence of labor and by the fact that it ceases after parturition. The more abundant the albumin the more gradual is its disappearance. The albuminuria of the puerperal period is the continuation of that of labor, and is never a separate condition. The albuminuria of labor is most pronounced toward the end of parturition, especially in cases of difficult or complicated labor. Circumstances which do not tend to make parturition especially difficult have no influence upon its albuminuria. The sediment of urine taken during labor shows organized material, including cylindroids, so often seen in cases of abundant albuminuria. These cylindroids are not abundant and are to be distinguished from others by the fact that they contain superficial kidney epithelium in abundance, but not the elements which come from the deeper kidney structures. In the normal puerperal period the sediment gradually and completely disappears. The passage of urine during labor is usually within the normal average limit, increasing after the delivery of the foetus, then growing less some hours later, and during the first days after delivery does not reach the average quantity. The specific gravity of the urine after labor is not, as a rule, abnormal; the quantity of albumin does not vary from that of blood serum or of the urine obtained after simple congestion of the kidneys. Increased quantities are sometimes observed after labor and seem to be connected with the congestive condition of the kidneys already described. The rapid disappearance of cylindroids and albuminuria after labor proceeds of itself without any essential alteration in the kidney. It is fair to conclude that an uncomplicated labor following an average normal pregnancy cannot produce definite disease of the kidneys. In some cases among the albuminoid bodies found in the urine of parturient patients there is found a certain albuminoid substance reacting to acetic acid. Its degree of solubility does not seem to be influenced by the condition of the kidneys. In normal circumstances albuminose is not found in the urine of parturient and puerperal patients, nor can there be detected a puerperal peptonuria. The probable causes of the albuminuria seen at labor are violent muscular exercise, cooling of the surface of the body, excitement of the central nervous system, venous stasis, toxins produced by the foetus, wounds of the genital tract during labor, which often affect the urethra and bladder. These causes produce their result by mechanical and chemical means. Under the first class are disturbances of the circulation, greatly increasing arterial tension and traumatism, followed by mild auto-intoxication. It can well be understood that in a patient having kidneys already diseased or with a predisposition to nephritis, pregnancy and labor might result in permanent damage to the kidneys.

The Absorption of Bone by the Uterus.—KOEBCNER (*Archiv f. Gyn.*, 1910, xei, Heft 1) has conducted at the Laboratory of Fraenkel, in Breslau, investigations to determine the question as to the possibility of absorption of foetal bone in the uterus. He concludes from his experiments that it is perfectly possible for bony material to be absorbed within the uterus. The inspection of foetal bones shows that in three cases foetal absorption could be detected, with also that of bony material. Cicatricial tissue was observed in the corpus luteum on the nineteenth

day of pregnancy, and the question arises whether this had any influence upon the condition of bony tissue in the embryo or foetus. It is not difficult to understand that bony material and especially calcium can be absorbed in the body. In osteomalacia and rickets this occurs constantly. In the growth of the skeleton in various diseased processes the same thing happens.

Transplantation of Ovaries.—HIGUCHI (*Archiv f. Gyn.*, 1910, xci, Heft 1) has conducted experiments upon this subject, and reviews the literature already in existence. He concludes that the autoplasmic transplanted ovary heals in its new location, and although it undergoes some alterations, especially diminution in size, was able to perform its functions a year after the operation. The mucosa and glands of the uterus became hyperplastic. The muscular tissue at the mesometrium is of normal thickness and is smaller upon the free side. The mucous membranes of the Fallopian tubes and the vagina are also hyperplastic, but not to the same degree as that of the cornua of the uterus. An ovary transplanted from one animal to another of the same species becomes greatly altered, losing its typical appearance, and undergoes marked atrophy or disappears. The mucous membranes and glands of the uterine cornua and cervix are markedly atrophied. In the muscular cells the uterine glands and papillae and in the connective tissue atrophy is especially marked, and this process gradually extends to the cervix, Fallopian tubes, and vagina. Human ovaries transplanted become entirely absorbed.

Labor after Extraperitoneal Cesarean Section.—LICHTENSTEIN (*Zentralb. f. Gyn.*, 1910, No. 26) reports from Zweifel's Clinic in Leipsic two cases of labor in patients previously delivered by extraperitoneal section. Case I had a flat rachitic pelvis, and had had the ordinary Cesarean section in 1904 and the cervical extraperitoneal section in 1908. The child seemed large and vigorous, in the first position, vertex presentation. The head was movable about the entrance to the pelvis. After pains had continued during the night, operation was performed during the morning following. The os was then the size of a half dollar, the membranes unruptured, and the fascia was easily opened without opening the peritoneum. The recti muscles were pushed aside and the peritoneum separated from the bladder and anterior portion of the cervix and stitched to the abdominal wall, closing off the peritoneal cavity. A longitudinal incision was then made in the cervix, the membranes ruptured, and the child delivered with forceps. The placenta was expressed, the wound of the cervix was closed with catgut, and the fascia wound with continuous catgut stitches. The peritoneum was brought down and stitched to its original situation at the base of the bladder, and the abdomen closed. This was the first extraperitoneal section performed upon the patient, in which she made a good recovery. About a year afterward she again returned to the Clinic, pregnant, and soon after came into labor. The patient complained of pain in the scars of the previous operations. The head was movable above the pelvic brim. The patient requested that the possibility of conception in the future be prevented. Accordingly abdominal section was practised, and the anterior wall of the uterus found adhesive to the abdom-

inal wall. The adhesions were separated, the uterus opened, and the child delivered. The cord was wrapped firmly about the neck and the child was deeply asphyxiated, but revived. The placenta was removed, the uterus sutured, and sterilization was performed by excision of the tubes. Inspection of the tissues showed no abnormality as the result of the previous cervical operation. There was no thinning of the uterine wall, and by palpation the scar could not be found. The patient made a good recovery. Case II had had an extraperitoneal cervical section, with transverse incision above the pubes. The operation had been successful and the patient recovered without incident. During the subsequent pregnancy the patient was in remarkably good health and complained of no distress as the result of the first operation. In the second pregnancy polyhydramnios and twins were diagnosticated. When the patient came into labor, twin pregnancy was present. It was found that the first child could not descend, as the children seemed to become blocked at the entrance of the pelvis. Version was then performed and the first twin extracted. The membranes of the second were then ruptured, and it was delivered by version. The first twin survived, the second was stillborn with anasarca and acites. The mother made a good recovery. Lichenstein also quotes 8 cases collected by Hartmann and 1 by Scheffzek, in which extraperitoneal section had been repeated. The birth had occurred one or more years after an original operation. In these operations the patient was left in good condition afterward and the tissues in practically normal condition

GYNECOLOGY.

UNDER THE CHARGE OF

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Abdominal Total Extirpation of the Uterus, Ventrofixation of the Vaginal Fornix; Procedures in Extensive Prolapsus.—O. KÜSTNER (*Monatschrift f. Geburts. und Gynäk.*, 1910, xxxii, 1) is not satisfied with his results in such cases when treated by vaginal hysterectomy combined with anterior and posterior colporrhaphy. Prolapse of the anterior vaginal wall and cystocele constitute the prominent features of a recurrence. The following procedure has given him good results. Longitudinal hypogastric incision, with extirpation of the uterus and adnexa. The vaginal cuff is closed transversely and covered by peritoneum, the median peritoneal sutures also passing through the vaginal wall. The vaginal stump is then fixed to the lower angle of the incision by means of 6 to 8 silkworm-gut sutures which include peritoneum, subperitoneal tissue, and fascia. In closing the abdominal wound, the suture at the lower angle also picks up the vaginal stump. If the patient's condition permits, posterior colporrhaphy is performed.

Gonorrheal Salpingitis: A Histological Study.—F. B. GURD (*Jour. Med. Research*, 1910, xxiii, 151.) According to AMERSBACH, a positive diagnosis of gonorrhœal salpingitis can be made in those cases presenting infiltration of the thickened folds of mucosa with plasma cells, lymphoblasts, and lymphocytes, in which the cellular infiltration in the wall is made up principally of plasma and lymphoid cells and in which the free pus contains a considerable percentage of lymphoid cells, lymphoblasts, and plasma cells. The author has carefully studied twenty cases of salpingitis, and finds that eighty per cent. were probably of gonorrhœal origin. With proper care and technique, the gonococcus can be cultivated in a large percentage of cases, even in old lesions—35 per cent. in his series. Old pus collections may become the nidus for infection by other organisms, such as the colon bacillus. This organism in all probability enters the already present pyosalpinx by direct passage through the tissue from the frequently adherent sigmoid. The appearance of the tubes examined in the series suggests that the exacerbation of symptoms which occurs periodically in cases of chronic salpingitis, is due to the repeated involvement of the peritoneal covering in an acute inflammatory process. Although it is apparently impossible to speak definitely of the distinctive histological picture of gonorrhœal salpingitis, the great preponderance of plasma cells over the other inflammatory cells, as well as the localization of the lesion chiefly in the mucosa and submucosa, are strongly suggestive of the gonorrhœal origin of an affection. The gonococcus invades the tube by means of continuity of surface, and the histological picture is probably to a great extent dependent upon this fact.

The Involution of the Corpus Luteum.—MILLER (*Archiv f. Gynäk.*, 1910, xc, 263), as the result of his examinations, concludes that the fresh corpus luteum contains no neutral fat; only after the beginning of involution can fat be demonstrated in the lutein cells. Fatty degeneration in the corpus luteum of pregnancy occurs only during the puerperium. The menstrual corpus albicans is due solely to hyaline hypertrophy of the connective-tissue reticulum, with disintegration of the lutein cells which have undergone fatty degeneration. Simple necrosis predominates over fatty degeneration in the retrogression of the corpus luteum of pregnancy. The corpus luteum is penetrated by numerous processes of connective tissue, which later undergo hyaline degeneration. In the second half of pregnancy, or even earlier, the majority of cases show colloid degeneration of the lutein cells, which proves their epithelial rather than connective-tissue origin, since colloid is the product only of epithelial cells. The menstrual corpus luteum usually shows no colloid, or, if present, only as minute, widely scattered drops. Toward the end of pregnancy and during the puerperium the corpus luteum practically always contains lime salts, which are never present in the menstrual corpus luteum. Therefore, the presence of lime salts or considerable colloid is diagnostic of the corpus luteum of pregnancy. One should not confuse true lutein cells with cells containing fat granules, which result from a chronic inflammation, as the author has observed in the ovary, tube, uterus, omentum, and appendix.

Retroversioflexio Uteri.—During the past ten years 304 cases have been operated upon in the Schauta clinic for retrodeviation of the uterus. Vaginal operations were employed in 228 cases, abdominal in 73, and the Alexander-Adams in 3. ADLER (*Monatssch f. Geburts. u. Gynäk.*, 1910, xxxii, 298) gives in detail the end results of 182 cases, the interval since operation varying from one to ten years, with the exception of five cases of eleven months duration. Uncomplicated retroversion often presents no symptoms, or the patient may complain of sacral backache, dragging sensation, a feeling of pressure in the rectum, and, less frequently, bladder disturbances; the chances of conception are probably lessened. An analysis of his cases gives conclusive evidence that menorrhagia and metrorrhagia are due, not to the malposition of the uterus, but to associated complications, such as metritis, myomas, disease of the adnexa, etc. Treatment is instituted only in the presence of symptoms which can be attributed to the backward displacement. If the uterus is freely movable, it is replaced and held in position temporarily by a pessary. Should the symptoms be relieved and the uterus fail to remain in good position after removal of the pessary, operation is advised. He is strongly opposed to the prolonged use of the pessary. Operation is employed in cases of adherent retrodeviation only after conservative measures have failed. For movable, uncomplicated displacements, the author prefers vaginal fixation of the round ligaments in the region of the urethra, an operation not yet published. Doleris' (Gilliam) operation, which has given ideal results in 33 cases, is employed when the uterus is adherent, when a movable displacement is accompanied by disease of the adnexa or appendix, and in virgins.

A Deceptive Form of Appendicitis in Women.—CROSSEN (*Surgery, Gynecology, and Obstetrics*, 1910, xi, 196) reports two unusual cases of appendicitis the recognition of which is important from the standpoint of both diagnosis and treatment. Clinically, both cases ran an extremely chronic course, with comparatively mild inflammatory symptoms. The pelvic examination revealed a flattened, firm, somewhat tender, and fairly movable mass in the right ovarian region. At operation the cecum occupied the right side of the pelvis and was held down by a few frail adhesions. After freeing the adhesions, the freely movable cecum revealed what appeared to be an intracecal mass, occupying its inner aspect and extending to the ileocecal junction. The mass could easily have been mistaken for carcinoma or tuberculosis. The true condition of affairs was explained, however, by finding a chronically inflamed, retrocecal appendix completely buried between the adherent folds of a greatly thickened cecal wall. The appendix was removed and both patients made a complete recovery, although absorption of the infiltration in the cecum required five months in one case and nearly a year in the other.

The Operability of Recurrence Following Radical Operation for Carcinoma of the Uterus.—HOEHNE (*Monatssch f. Geburt. u. Gynäk.*, 1910, xxxii, 161) shares the view of von Rosthorn and Franz, that in selected cases recurrence should be removed by operation. Should the recur-

rence be of the diffuse, infiltrating type, operative intervention is useless; when the carcinoma presents itself as a more or less circumscribed nodule, especially when situated in the region of the scar of the primary operation, excision is advisable. Two cases are cited illustrating the value of this procedure. He urges the importance of a routine examination following radical operation. The patient is instructed to return at a definite time, and if the examination reveals a suspicious swelling, she is kept under close observation for two weeks. Should the mass enlarge, it is in all probability carcinomatous, and requires operation; with no enlargement, the patient is discharged and re-examined at regular intervals. By following this plan, the author is convinced that the number of permanent cures will be considerably increased.

DISEASES OF THE LARYNX AND CONTIGUOUS STRUCTURES.

UNDER THE CHARGE OF
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Laryngeal Stenosis as a Frequent Result of Operation Involving the Hyoid Bone.—MOURE (*Annales des mal. de l'oreille, du larynx, du nez, et du pharynx*, June, 1910), having had occasion to practise a number of operations involving transhyoid section, was able to watch a certain number of cases for some time after operation, and in every one of them he found, as a result of the operation, a laryngeal stenosis due to antero-posterior elongation of the glottis, which during inspiration took the form of an ellipse instead of the isosceles triangle. As a result of this abnormal condition the arytenoids are unable to separate in the middle line, the vocal cords remain in juxtaposition, or at least so little separated from each other during inspiration that respiration is found greatly compromised. The laryngoscopic image is that of paralysis of both dilators of the glottis, with this difference, however, that the orifice is changed in form.

A Safe Intranasal Method of Opening the Frontal Sinus.—THOMSON (*Laryngoscope*, August, 1910) combines the best features of the methods of Ingals and of Goode into what he believes to be a perfectly safe as well as a simple operation. The anterior end of the middle turbinate is removed and a probe passed into the frontal sinus. A pointed rasp similar to Goode's but grooved on its back is guided as far as it can be pushed by reasonable pressure, and then withdrawn, cutting away the bone downward and forward, leaving room for any instruments that may be required for the removal or destruction of tissue. Healing is said to occur quickly, with immediate relief to the severe headaches attendant on suppuration of the frontal sinus.

Fracture of the Thyroid Cartilage.—MATTHEWS (*Jour. Amer. Med. Assoc.*, September 10, 1910) reports a case in an insane man, aged forty-nine years, who had been forcibly struck over the larynx by a fellow inmate. Examination disclosed complete fracture of the thyroid in the median line. Immobilization was secured by compresses on each side, held in place with adhesive strips. Food was prohibited for twenty-four hours. Hoarseness continued for four days, when rapid improvement ensued. The fixation strips were removed on the seventh day and a perfect union was found. On the ninth day the patient was up and about as usual.

Postoperative Acute Meningitis in Frontal Ethmoidal Sinusitis.—JACQUES (*Annales des mal. de l'oreille, du lar., du nez, et du pharynx*, June, 1910), having observed two cases of this complication, with death in forty-eight hours after operation, found the whole subarachnoid space invaded with pathogenic germs, streptococci and pneumococci. He therefore counsels that if operation appears necessary during the course of the painful exacerbation of the disease, the operative intervention should be limited to simple trepanation of the frontal sinus in the neighborhood of its floor, without decortication, and followed by external drainage. He also believes it would be prudent in operating upon chronic ethmoidal sinusitis to respect, as much as possible, the upper turbinate, the region of the cribriform plate, and the olfactive portion of the septum in the region of the cribriform plate.

Enchondroma of the Larynx.—MOURE (*Revue hebdomadaire de laryngologie et d'otologie*, August, 20, 1910) reports a case of very large lobated enchondroma of the upper portion of the larynx, attached to the left aryteno-epiglottic fold and the left wing of the thyroid cartilage. Preliminary tracheotomy was performed. Three weeks later the removal of the growth was undertaken by external access under local anesthesia. The growth was so large that it had to be removed piece-meal, and some of the pieces, being too voluminous to be removed through the thyroidal incision, had to be pushed into the mouth, whence they were expectorated. After some tribulation the patient made a good recovery, but it was some time before he could be relieved of the tracheal cannula.

Chondroid Fibroma of the Subglottic Region of the Trachea.—MOURE (*Revue hebdomadaire de laryngologie et d'otologie*, August 20, 1910) reports a case of an extensive growth of the trachea, of which large portions were removed by external access after incision, under local anesthesia, of the upper five rings of the trachea. Although immediate relief followed the operation, and the patient respired freely, unfortunate complications set in and the patient succumbed by suffocation at the end of a week. At the autopsy extensive stenosis of the trachea was revealed, due to unremoved and unremovable but unsuspected continuations of the growth. The cricoid cartilage was completely degenerated, crumbling at the slightest contact, and was totally deformed.

Simplification of the Radical Operation for the Cure of Maxillary Sinusitis.—MOUNIER (*Jour. Laryng.*, August, 1910) operates at one sitting without subsequent dressings. He does not resect any part of the inferior

turbinate body, and he makes a very small sinuso-nasal opening with his special cutting forceps. Traumatism is said to be reduced to a minimum, and the patient to be laid up for a very few days only.

Sepsis following Tonsil Operations.—DEAN (*Laryngoscope*, July, 1910) contributes an elaborate article upon sepsis following operations on the tonsils, and reports a case of death from sepsis, a case of cerebral thrombo-sinusitis, and a case of gangrene of the muscles of the neck, following tonsillectomy.

Complications of Adenectomy.—As immediate mishaps, PARREL (*Jour. Laryn.*, August, 1910) mentions burns, and breakage of instruments; and as remote complications, synechiæ, adenitis, latero-retro-pharyngeal inflammations, pulmonary abscesses, and lastly, generalized septicemia. To avoid these he advises the operation in Rose's position, under chloride of ethyl, abstinence from hurry, attention to asepsis, and a strictly surgical technique.

Submucous Turbinotomy.—In the numerous cases in which enlargement of the turbinate body is due to the magnitude or to the unusual shape of the bone, ZARNIKO (*Jour. Laryn.*, August, 1910) recommends submucous resection of the turbinal bone instead of the undesirable removal of the entire structure. He has performed over thirty such operations during the last two years, making careful selection of his cases, and is well satisfied with his results. He considers it as a necessary adjunct to many submucous resections of the septum.

HYGIENE AND PUBLIC HEALTH.

UNDER THE CHARGE OF

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Parasitic Culture.—DAWSON (*Popular Science Monthly*, September, 1910) discusses this subject in an interesting and unique way. In fact, he opens up questions of the greatest importance in both physical and mental development. Starting out with the generally admitted fact that functionless organs are harmful to the body as a whole, he develops the thesis that overtrained organs, whether muscle or nerve, are also harmful. He holds that the athlete is none the stronger on account of the unusual development of his muscular system. On this point he makes the following statement: "It has been observed by physicians that very frequently athletic types of manhood have weak hearts, weak lungs, and weak vital organs generally. Often their health and efficiency in later life are poor; and in not a few cases they break down prematurely. These observations have set both medical men and teachers of physical culture to thinking, and we are now being told that there is danger of overdeveloping the muscular

system; that overdeveloped muscles impose a severe strain upon the rest of the organism; and that all muscular development, unless it is utilized, becomes a tax upon bodily energy, and may give rise to disease. Only very recently a naval officer, who was an athlete while in the Naval Academy, is reported as having failed to meet the required tests of physical efficiency; and his physician ascribes his failure to his earlier muscular development in excess of the needs of his later life. That is to say, "his vitality was reduced through parasitic muscular culture." He also quotes with approval the following from Payot's recent work on the *Education of the Will*: "The qualities of vital resistance are in no way dependent upon muscular strength. A man may be an athlete in a circus, or able to do the heaviest porter's work, and yet have very poor health, while another man who lives in his study may have an iron constitution with mediocre muscular power. Not only have we no reason to aspire to athletic strength, but rather we ought to avoid it; because it can only be developed by violent exercise, and such exercises not only interfere with the regularity of the respiration, and cause very distinct congestion in the veins of the neck and brow, but they are undoubtedly weakening and exhausting. We have come to the conclusion, therefore, that it is not England with her violent system of exercise which we ought to imitate in this connection, but rather Sweden, who has completely given up such ruinous physical efforts for young people in her schools. There the object is to make young people strong and healthy, and they have perceived that excessive physical exercises are more sure to lead to a breakdown than excessive study." In like manner, Dawson holds that the excessive time and effort given to mathematics and the classics overdevelop certain neurons which are but little used in after life, but which must be maintained at the expense of the organism. This interesting article is summarized by its author as follows: (1) It is a law of the biological world that unused organs become parasitic upon the life, draining off the energy of the individual and tending to become diseased. (2) It has been found that physical culture, which leads to the hypertrophy of special muscles, entails a drain upon the general vitality. As in life in general, so in physical education, organs that can perform no adequate function are wasteful of human energy. (3) Experimental psychology is showing that the culture of particular intellectual organs and functions cannot be transformed to other organs and functions, except where there are elements in common. Histology and pathology of the nervous system confirm the conclusions of psychology in this respect. (4) Intellectual culture, not being transferable, must become parasitic and a cause of mental disorganization when it fails of application and usefulness in the life of the individual. Illustrations are to be found in the over-refinements of culture in academic communities, in the nervous instability frequently met with among educated men and women, and in the religious and social vagaries and perversions that crop out in the older and more highly cultivated centres of population. (5) The artificial culture of the secondary schools and colleges in our democratic society, in proportion as it is diffused through larger sections of our population, is likely to develop a cultured proletariat, ill-balanced and inefficient as individuals and a source of danger in our civilization."

The Presence of Negri Bodies in the Saliva.—GANSLEY (Centrbl. f. Bakteriologie, 1910, lv, 487) inoculated guinea-pigs and rabbits with forty samples of the submaxillary saliva of rabid dogs, and in thirty-seven of these experiments rabies resulted. In none of these samples of saliva, also in none of twenty samples of parotid saliva, could Negri bodies be detected by the application of the staining methods ordinarily employed in searching for them in nerve tissue.

The Tropical Sunlight.—FREER (*Philippine Jour. Sci.*, 1910, v, 1) reports upon the work now in progress in the Bureau of Science on the effects of sunlight in Manila. Much has been written on the subject within recent years, but the problem is a complicated one, and hasty conclusions may be rendered if all factors are not given due consideration. Some years ago it was generally held that the solar spectrum is divisible into three classes of rays. Those of the blue, violet, and ultraviolet regions are designated as actinic and cause chemical changes in the substances upon which they fall. Those in the visible field cause light, while the ultrared produce heat. However, it was shown by Bunsen and Roscoe, as long ago as 1859, that there is no sharp line of demarcation between these sets. One man's vision may take in much more on either side or on both sides than the other, and chemical changes and elevation of temperature are not wholly wanting in the field of vision. Still, three divisions roughly hold good. The intensity of the actinic rays has been studied by their effects upon carbolic acid and aniline, oxalic acid, and other chemical bodies. The coloration of phenol by exposure to sunlight is due to oxidation, and the presence of moisture is not necessary. "Crystals of such pure, dry phenol, when sealed in a tube with pure, dry oxygen and placed in the sunlight in Manila, at a temperature of approximately 30°, color perceptibly after two hours, and the entire mass changes to a deep red liquid after five days." When pure aniline is sealed in a thin glass tube and exposed to the direct sunlight, it darkens and assumes a red shade in less than ten minutes. Methyl alcohol is speedily converted into formaldehyde, and methyl salicylate is decomposed, and the alcohol formed is changed into formaldehyde. These reactions show that tropical sunlight induces chemical changes which either do not take place at all or proceed very slowly in temperate climates. Whether the intensity of the actinic rays is the specially harmful factor in the effect of tropical sunlight on the white man, or not, remains to be determined.

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ORIGINAL ARTICLES.

PLEURISY AS A COMPLICATION AND A SEQUEL OF LOBAR
PNEUMONIA: ITS DIAGNOSIS AND TREATMENT.¹

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It is universally conceded that pleurisy is the commonest complication of the pneumonic process. The precise definition of the condition, however, is difficult. In my view, pleurisy should be regarded as a complication only when it co-exists either as a severe form of the dry plastic variety or is accompanied by sufficient effusion to be easily demonstrable by means of the physical signs. On the contrary, the slight dry pleurisy, which is ordinarily associated with pneumonia and disappears promptly with the occurrence of the crisis, should be looked upon as a part of the pathological picture of the disease.

Apart from the commoner forms of complicating pleuritis, which arise either during or following the active stages of the pneumonic process, and yield either serum or pus, there are instances of pleurisy, principally of the plastic variety, that clearly precede the development of a pneumococcal infection of the lung (pneumonia). This class of cases is one that has not received the measure of consideration on the part of medical writers that it seems to me to merit.

In the course of my observations of pneumonia with an atypical onset, clinical indications of dry or plastic pleurisy alone have been demonstrable by means of the physical signs during one, two, or more days, in some cases, at least. In rare instances, a moderate amount of either serofibrinous or purulent exudate may be present for a similar, variable, period of time prior to the appearance of the succeeding pneumonic features.

¹ Read at a meeting of the Ohio State Medical Association, Toledo, Ohio, May 12, 1910, and in a modified form at a meeting of the York County Medical Society, Pennsylvania, February 3, 1910, and the Delaware County Medical Society, Pennsylvania, July 7, 1910.

It is not possible, at present writing, to make any definite statement as to the proportion of cases of lobar pneumonia in which foregoing pleurisy occurs. On theoretical grounds, however, we can readily conceive of primary pneumococcic infection of the pleura with subsequent involvement of the lung texture from extension. Perhaps the majority of instances belonging to this class are met with in the secondary form of lobar pneumonia, or that which arises in the course of the acute infections and certain chronic diseases, such as, chronic nephritis, organic heart affections, and the like.

To distinguish the cases of pleurisy under consideration from those presenting identical signs, but without any tendency to merge with ensuing pneumonic features (simple pleurisy), is often difficult in the extreme. An initial chill may occur in cases in which pleural involvement, followed by lobar pneumonia, arises in apparently healthy individuals; this should invite attention to the possibility of its having been a pneumococcic infection from the beginning. On the other hand, the rigor may be absent in such cases. An examination of the blood usually reveals a leukocytosis, which often develops rapidly, in the hybrid under discussion. Again, the systemic prostration is greater and the temperature range higher than in non-pneumococcic pleurisies. In suspects, it is well to attempt to demonstrate the pneumococcus in blood cultures, if no pleural exudate be obtainable, but for this purpose large quantities of blood (not less than 15 c.c.) are required.

A bacteriological study of the exudate when present is invariably to be advised and encouraged, and it is the only reliable means of drawing an etiological distinction between the recognized varieties. It is to be recollected also that pneumococcic pleurisy may occur quite independently of any involvement of the lung texture; but the cases falling under this head are rare, and occur oftenest among children with symptoms resembling those of pneumonia, although the physical signs are those of pleural effusion. It is possible, as some contend, that patches of consolidation, of larger or smaller size, are undiscovered; hence these would be examples of pneumonia complicated or cloaked, as it were, by a pleural effusion.

INCIDENCE OF SEROFIBRINOUS AND PURULENT VARIETIES. The relative proportion of cases in which the exudate is purulent or non-purulent when pleurisy complicates pneumonia is not definitely known, although there are at hand a considerable number of figures bearing upon the question. Fraley,² in 52 cases of pleurisy occurring in connection with 500 cases of lobar pneumonia, found that only 4 were of the serofibrinous variety, while 48 were empyemas. On the other hand, Norris,³ in an analysis of 500 cases of croupous pneumonia, noted pleurisy as a complication in 18, of which, 12 were of the serofibrinous form and 6 were empyemas. In dealing with

² AMER. JOUR. MED. SCI., May, 1907

³ Ibid., January, June, 1901, p. 684.

the question of pleural effusions in children as related to lobar pneumonia, two points deserve especial notice: First, as compared with adults, purulent effusions from all causes are more frequent relatively than serous, and secondly, during early childhood not less than 75 per cent. of empyemas from all causes are due to the pneumococcus according to the figures of Netter, Blaker, Bythell, and others.

It has been pointed out repeatedly that pleural effusions in children are generally purulent from the beginning, whereas in adults empyemas are more apt to originate from a serofibrinous exudate. Says Emanuel,⁴ pertinently: "If we are going to compare an empyema of a child with one in an adult, we must take pains to compare empyemas which are alike bacteriologically." At present, however, it is an accepted fact that practically all pleurisies found in connection with pneumonia are due to the pneumococcus.

A consideration of available statistics for all periods of life by Musser and Norris,⁵ leads to the inference that empyemas, if we include metapneumonic cases, are of common occurrence, but by no means so frequent as serofibrinous effusions in connection with lobar pneumonia. These observers found that of 24,511 cases of pneumonia, pleural effusion occurred in 1535, or 6.26 per cent. At a later date, Cameron⁶ analyzed 217 cases of primary pneumococcal pneumonia, personally observed, of which 65 were over twenty years of age and 120 under that age (32 not mentioned). Of these, 15 were complicated with empyema—only 7 of the latter patients being over ten years of age, and 8 under. "Of 1331 cases treated in Guy's Hospital, empyema developed in 45, or 3.3 per cent."

On the other hand, in 974 autopsy records in pneumonia, pleural effusions were encountered in 415 or 41.58 per cent. Again, of 973 necropsies in pneumonia cases, 50, or 5.1 per cent., were empyemas. Norris autopsied 127 pneumonia cases, and found pleuritis in 59, or 46.4 per cent., as follows: Fibrinous, 23; serous, 5; fibrous, 11; and purulent, 20. Kerr, in 173 pneumonia autopsies, obtained results that differed markedly from the above, namely, acute fibrinous, 74; acute serofibrinous, 78; and acute purulent (empyemas), only 6. Obviously, the results from postmortem examinations show a larger number of cases of serofibrinous and fibrinous pleurisy proportionately than antemortem observations, for the reason that the condition is of too light a grade in many instances to be detected during life by means of the physical signs. On the other hand, the antemortem and postmortem observations in cases of empyema do not seem to present the same discrepancy.

BACTERIOLOGY. It is to be recollected that the gravity of the condition depends so largely upon the particular species of bacteria

⁴ Reports of the Society for the Study of Disease in Children, 1906, vi, 75.

⁵ Osler's Modern Medicine, 1907, ii, 597.

⁶ Australasian Medical Gazette, Sydney, November 20, 1908.

⁷ Matheny, Surgical Complications of Pneumonia, with Special Reference to Empyema, Penna. Med. Jour., March, 1909.

present in the given case of pleuritis as to make the question of its bacteriological cause one of the utmost practical importance. That the pneumococcus has great power of invasion of the pleural cavity from the lung is an accepted fact, but when this extension of bacterial activity takes place in cases in which empyema arises as a sequel of pneumonia is still unknown. The pneumococcus is often found in a state of purity in pleurisy complicating pneumonia, but it may also occur mixed with the streptococcus, the staphylococcus, the tubercle bacillus, and rarely with other organisms.

As before stated, the pneumococcus is quite generally the bacteriological factor in pleurisies associated with pneumonia, whether they be serofibrinous or purulent. While the bacteriological work that has been done in empyemas secondary to pneumonia has given results which may be regarded as definitely conclusive, the same is not true of serofibrinous effusion. To determine the bacterial agent present in the latter exudate is confessedly difficult, but fortunately it may be fairly assumed that almost invariably the pneumococcus is found in pure culture. As in the case of pneumococcic empyemas, however, so here, other microorganisms, especially the streptococcus, or the staphylococcus, may rarely be found mixed with it. In cases of pneumonia in which the streptococcus occurs in the pleural cavity, it also occupies the lungs in association with the pneumococcus, and may excite pulmonary abscess. The foregoing facts concerning the bacteriology of pleurisy found complicating pneumonia must be borne in remembrance in view of their practical bearings upon its prognosis and treatment.

DIAGNOSIS OF PLEURITIS, THE COMPLICATION IN PNEUMONIA. The diagnosis of associated dry or plastic pleurisy, the commonest variety, can be definitely recognized by the friction sound, except in the stage of complete solidification of the lung when it is missing owing to the absence of any expansive motion of the chest. Both in the first and third stages of these cases, pathologically speaking, the friction rub, however, is generally detectable, if care be exercised in the examination. We must recognize the well-established pathological truth that a certain, although often mild, grade of pleurisy is present in practically every case of pneumonia. Moreover, friction sounds may be detectable at any stage of pneumonia in cases in which the lung is imperfectly solidified. A serofibrinous exudate occurring in connection with pneumonia is usually recognizable by means of the physical signs, which, however, are modified by the consolidated lung texture. (Physical signs of empyema, *vide infra*.)

As to the time of occurrence of the complicating pleurisy, there is wide discrepancy of opinion among authors and writers, some contending that it more often develops during the course of the fastigium than as a sequel, while others affirm the contrary view.

In cases of pneumonia with complicating serous pleurisy, the crisis followed by resolution generally occurs at the customary period of the disease, and the effusion may then disappear with extraordinary

rapidity. A case in point has recently fallen under my care at the Medico-Chirurgical Hospital, in a female, aged twenty-six years, and this experience has not been an uncommon one.

In a second group of cases, the physical signs of effusion may be either well defined or more or less indefinite, but the fever is protracted beyond the usual time for the occurrence of the crisis. Recent experience, has shown me that such a temperature chart is of even greater value in the determination of associated pleuritis than is generally supposed. The curve remains irregularly elevated, but does not present the septic type, unless the pleural infection be caused by the streptococcus. That an intermittent form of fever curve may rarely be observed, due to mixed infection, must be granted. A gradual fall of temperature in pneumonia in lieu of the more common crisis is oftener due to associated pleuritis than to any other single cause.

A rising leukocytosis with the onset of a secondary pleurisy has been noted by A. Lambert and R. M. Daley,⁸ in one case the count varying from 19,600 to 25,400. Granting that further observations of the leukocyte count will confirm this finding, it must be recollected that extension of the pathological changes of the pneumonic process, and complications other than serofibrinous pleurisy, may likewise cause a sudden rise of leukocytosis. It may be said at present that this symptom is not sufficiently established to be of more than corroborative value as a diagnostic factor in pneumonia with complicating serous effusion.

Movable dulness or flatness, that most characteristic sign of a liquid exudate, should not be investigated for, since to place the patient ill of pneumonia in the sitting posture during the attack may be attended with distinctly harmful effects. A sign of high value in the diagnosis of complicating pleurisy is absence of vocal tactile fremitus. It is well to resort to the exploring needle in a dubious case after noting the physical signs, and it is my custom to employ for the purpose a hypodermic syringe having a needle somewhat longer and of slightly larger caliber than that ordinarily used in subcutaneous medication. In serofibrinous effusion a larger needle is rarely required, although it is not safe to exclude pleurisy if fluid fails to be obtained on so-called needling. It is the part of wisdom to resort to a full-sized exploring needle in highly suspicious cases, if occasion demands. Here I may be allowed to state my firm belief, based on personal observation, that shock, even of the slightest degree of intensity, is badly borne by pneumonia patients, and it is for this reason that the smallest needle that will suffice is to be preferred.

Although most serofibrinous pleurisies are pneumococcal, a careful bacteriological and cytological examination of the exudate is nevertheless to be advised. Thus, as is well known, if the withdrawn

⁸ Leukocytosis in Pneumonia, St. Paul Med. Jour., 1902, p. 849.

fluid should contain a preponderance of small mononuclear cells or lymphocytes, the pleurisy is probably tuberculous in nature. Here may be pointed out the fact that concomitant infection of the pleura with both the tubercle bacillus and the pneumococcus may occur in rare instances, and the tuberculous infection is more commonly primary than secondary in such cases. This opinion is confirmed by that of Bythell, who has reported 4 cases in which "latent tubercle bacilli were stirred into activity by the penumococcus infection."⁹

In every case, therefore, it is important definitely to determine the presence or absence of pathogenic activity, due to organisms other than the pneumococcus, even though it be confessedly difficult to determine the bacterial agent by staining films after centrifugalization, by cultural methods, or, finally, by inoculation experiments.

Again, serofibrinous pleurisy may develop as a sequel, *e. g.*, one, two, or more days after the occurrence of the critical decline of fever. These postcritical serous pleurisies, if pneumococcal in origin, usually run a mild course with a moderately elevated temperature, the curve presenting no particular type. A pneumococcic serofibrinous pleurisy, however, may though rarely, pursue a severe course; when caused by the streptococcus, the pleurisy is generally accompanied by septic phenomena with a serious clinical aspect. Phagocytosis of larger or smaller amount may be present, particularly in the latter variety. In these residual or postpneumonic serous pleurisies, cough of an unproductive, irritative, useless nature is apt to occur and is aggravated by movement. Movable dulness may be elicited in these cases with safety to the patient. If, however, doubt surround the diagnosis, a needle should be introduced. The hypodermic syringe may not answer our purpose here, as was true of 2 of my cases, in which the effusion was decidedly fibrinoplastic in nature.

In serofibrinous pleurisy, as in empyema, investigation must embrace the entire chest, and it is to be especially recollected that pleuritis may attack the non-pneumonic side—a most serious condition if it develop prior to the occurrence of the crisis, and one that must be promptly met. Finally, while it is quite generally possible to recognize the existence of fluid exudate in the pleural sacs when present in any appreciable amount by noting carefully the physical signs, it is impossible definitely to determine whether it is a serofibrinous or purulent effusion without resorting to an exploring needle. I may add that he who entertains the belief that the distinction between pus and serum can be drawn in any other manner is only deceiving himself.

DIAGNOSIS OF EMPYEMA OCCURRING AS A COMPLICATION AND AS A SEQUEL OF PNEUMONIA. As before stated, almost all of the empyemas that develop during and after pneumonia are due to the pneumococcus pure, although double infection is not unknown.

⁹ Reports of the Society for the Study of Disease in Children, 1906, vi, 92.

The condition in any case may, as Bythell¹⁰ points out, extend its operations beyond its original seat of infection, thus possessing a dangerous power. Concerning the time of development of empyema in connection with lobar pneumonia, that is, whether before the crisis as a complication, or after that pivotal event as a sequel, opposite opinions are held. The medical profession is greatly in need of reliable statistics bearing upon this question. With the kind aid of my associate, Dr. H. Leon Jameson, I have been able to collect from the literature of the past two decades 218 cases, of which, only 66 could be classed as true complications, while 152 occurred as sequels.

Reporter and reference.	Empyema pre- ceding crisis (complication)	Empyema following crisis(sequel).
Flagler, Amer. Lancet, 1890, xiv, 363	1
Begg, Cleveland Med. Gaz., 1890-91, vi, 308	1
Drummond, Brit. Med. Jour., 1891, ii, 113	2	
Holt, Proc. New York Path. Soc, 1892, p. 90	1	
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Carr, Trans. Clin. Soc., London, 1892-93, xxvi, 29	1	
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An examination of the literature also revealed the fact that most writers who have reported cases of empyema in association with pneumonia have spoken of it as being a sequel in the majority of instances, at least. On the other hand, Thomas McCrae and A. Lambert contend that a preponderance of the cases arise before the crisis, and are, therefore, to be regarded as complications. A considerable number of instances were eliminated from consideration because of the fact that the time of onset could not be accurately determined from the accounts given. The selection of case reports was influenced largely by the temperature curve; thus, those in which the crisis occurred at or about the usual period followed by a fresh rise of fever anywhere from one to several days or more thereafter, coupled with the simultaneous appearance of the characteristic physical signs, were classed as sequels of the disease. Again, all instances that developed before the time for the crisis (and often prevented its occurrence) were regarded as complications, and so reported in the accompanying table.

The general features of pneumococcic empyema, whether it develops as a complication or a sequel, are usually more or less indefinite. In some cases, however, in which either a fistulous connection with a bronchus, or an empyema necessitatis, is established, chills, an exacerbating temperature curve, and sweats may occur.

Empyema, the complication, usually causes the temperature to fall by lysis, and an irregular fever curve may persist for weeks together in cases that go unrecognized and in those inappropriately treated. The examiner is, as a rule, enabled to recognize the presence of free purulent effusion by means of the physical signs.

The solidified state of the underlying lung, however, tends to modify certain of the more characteristic signs, as compared with those noted in cases in which the lung is healthy at the time of onset of the pleurisy. The tracheal sounds, therefore, are readily conveyed through the bronchi, and even through the fluid with slight change unless the effusion be copious in amount. Vocal resonance is also decreased to a less extent than in cases in which the lung is retracted or compressed by an exudate arising independently of lobar pneumonia; and the breath sounds, while faint or even inaudible at the extreme base, are apt to be more bronchial at lower levels than in primary empyema. The note to percussion, however, is flat with board-like resistance. In children, vocal fremitus is of little value as a diagnostic aid, and the breath sounds, except at the base posteriorly, are apt to be distinctly bronchial in quality over the effusion, and associated with augmented vocal resonance. As stated in connection with serofibrinous fluid, one must use the exploring needle, which in these cases should not be too small.

The diagnosis of *empyema occurring as a sequel* of pneumonia is free from difficulty, as a rule, if one does not neglect to note care-

fully the physical signs in any given case in which, following the usual crisis, irregular fever returns, the prostration increases, and there occurs a marked rise of the leukocyte count. These show the existence of pleural effusion, which invariably calls for an immediate exploratory puncture, followed by a bacteriological study of the withdrawn exudate. It should be further emphasized that the empyemas, which originate during the progress of a pneumonia, and in which the exudate is free in the pleural cavity, do not require exploratory operation for their recognition, as a rule, although it may become necessary to needle occasional obscure cases for purposes of diagnosis.

In the diagnosis of a *localized* (encapsulated) *empyema*, or one engrafted upon a pleura previously the seat of disease, many points of difficulty are presented. These small collections of pus rarely cause any noticeable bulging of the chest wall. A restricted expansive movement over a circumscribed area, especially during forced respiration, is an early and significant sign. Palpation will confirm inspection relative to the expansile motion of the chest, and will elicit diminished, or even absence of, tactile fremitus over the fluid, provided that the examiner uses his finger tips; but to detect this sign he may be obliged to cover every square inch of thoracic surface. Should the abscess, however, occupy a position between the lobes with more or less consolidation lying anteriorly, tactile fremitus may be increased rather than decreased, although this particular relationship of pathological conditions rarely obtains.

A most valuable sign, emphasized by Musser,¹¹ is localized tenderness to firm pressure over the interspace corresponding to the seat of the abscess. There may be also subjective pain; this is generally but not always referred to the circumscribed area of tenderness. Thus, it may be felt below the costal margin as in one of my cases, or anteriorly, at about the point where the intercostal nerves emerge from the deeper to the more superficial anatomical structures. When the localized infection implicates the diaphragm, the pain may be referred to the scapular region. On percussion, a flat note is usually obtained co-extensive with the abscess, but movable dulness is generally absent in these encapsulated empyemas. Neither does my personal experience confirm that of other observers, who have noted Skodaic resonance immediately over the loculated pus collection; but quite commonly this note is present over the surrounding lung texture when not the seat of consolidation.

Auscultation reveals either diminished or absent breath sounds, depending upon the size of the abscess. Thus in one of my cases, which was also seen by my surgical colleague, Dr. W. L. Rodman, a slight diminution in the intensity of the vesicular element of the breath sounds was the only auscultatory phenomenon. In this

¹¹ New York Med. Jour., December 7, 1907.

instance the abscess proved to be small, and after evacuating the pus recovery ensued promptly. When the abscess is situated between the lobes of the lungs (interlobar) near to their margins, a pleural friction sound may be audible in the earlier stages, at least, and tends, when coupled with the other signs, to localize the seat of the collection.

These small loculated empyemas are rarely recognizable by means of the physical signs alone, but in the presence of the general and local features of infection, particularly irregular fever, and the history of an antecedent pneumonia, we are justified in according to them a strong corroborative value, and they will often indicate the necessity for (and the site of) prompt surgical intervention.

The x -rays are of considerable value in detecting small or larger collection of pus in the pleural cavities, since they produce a denser shadow than that of a resolving pneumonic consolidation, which is so commonly a concomitant condition. Its circumscribed character will serve to distinguish an abscess from mere thickening of the pleura. It must be confessed, however, that the results of radiography are not always definite, and they must, therefore, not of themselves be regarded as conclusive. The results of x -ray studies, however, often aid us in deciding in favor of further explorations.

It is always difficult and sometimes impossible to differentiate an encapsulated empyema following pneumonia (abscess of the pleura) from pulmonary abscess without communication with a bronchus. This is particularly true if the purulent pleurisy be of the interlobar variety, and it must be recollected that abscess of the lung may be an associated condition. In pulmonary abscess, when it communicates with a bronchus, the sputum contains elastic fibers and shreds of lung tissue, both of which can be readily demonstrated. If the condition develop during the attack of pneumonia, the sputum changes in color appearance; it may become yellow, indicating its purulent character, grass green, or "hemorrhagic or blackish" (Leyden). The sputum emits an "offensively sweet" or even fetid odor. The signs of cavity formation develop if the abscess communicate with a bronchus, and these may be readily confirmed by means of the x -rays.

Exploratory puncture should be resorted to without delay in cases in which the special local and general features and physical signs are indefinite, but the failure to find pus in this manner must not lead us to exclude loculated empyema. The causes of a negative result are several. In the first place, the purulent collection may be small and environed by thick, dense adhesions, hence difficult to locate. Again, the instrument may be imperfect, or of too small a caliber. I am of the opinion that, notwithstanding failure to prove the presence of pus by puncture in cases in which the history, signs,

and symptoms leave little room for doubting the existence of an accumulation, an exploratory operation should be undertaken.

The physician, no less than the surgeon, must realize the dangers, both to the lung and general condition of the patient, of such collections, if allowed to remain, unless nature should be so fortunate as to be able to establish a fistulous connection with a bronchus or bring about rupture externally. On the other hand, the general condition of the patient may be such as to prohibit a safe operation, or render delay advisable for a time, but timely use of the method is to be advised in all instances in which distinct contra-indications do not exist. Indeed, to permit a circumscribed pleurisy following pneumonia to drag on with a view to waiting until spontaneous rupture occurs is inexcusable. Exploratory operation will not only clear the diagnosis, but also accomplish the cure in the immense majority of the cases.

Here I should not fail to point out that a concomitant non-loculated empyema (one developing in the course of the pneumonic process) is more benign than so-called metapneumonic empyema, which begins after the crisis, often in greatly debilitated subjects.

Exploratory puncture and timely surgical intervention will prevent shrinking of the lung followed by thoracic deformity in metapneumonic empyema. On the other hand, when the condition is too conservatively treated, or goes unrecognized, most cases terminate fatally after a long-continued fever, with chills and gradual exhaustion. The cases that rupture through the diaphragm, setting up subphrenic abscess, eventually die, if not recognized and treated surgically.

TREATMENT. It is manifestly true that the treatment of pleuritis developing before the crisis in pneumonia may require different management from that appropriate in cases arising after the occurrence of that pivotal event. When a serous exudate supervenes in the course of the pneumonic process, an expectant method of treatment, as before intimated, is to be advocated, first, because puncture followed by aspiration is badly borne in pneumonia cases, and secondly, for the reason that if the crisis is survived by the patient, the exudate quite generally is absorbed with surprising rapidity. If, however, the serous effusion does not promptly disappear following the crisis, recovery is to be hastened by puncture, which in my experience has been found to be successful. Again, the removal of a part of a massive effusion, which has displaced the heart and other adjacent viscera, is rarely necessary during the fastigium, and favors spontaneous resorption. Such cases, however, may rarely demand more radical operative measures for their cure later on (after the crisis), and these should not be too long delayed.

On the other hand, a complicating serous pleurisy may prevent the occurrence of the crisis in lobar pneumonia, fever of an irregular type continuing indefinitely, or the temperature dropping by lysis.

In such cases, if the effusion be copious and remain undiminished in amount, puncture should be undertaken early, and repeated if necessary.

Before leaving this aspect of my subject—the treatment of sero-fibrinous exudate in the course of pneumonia—I wish to emphasize the point that my own empiric results from aspiration in this disease prior to the time of the crisis or the beginning of resolution of the hepatized lung in seriously ill patients have been uniformly unfavorable, although I am ready to admit that other observers may deduce indications for its employment either by scientific reasoning or from experience.

Medical Measures. Remedial measures intended to control pneumococcic inflammations of serous membranes are of small value, and it is of the utmost importance to avoid the use of drugs that act as depressants in all pneumonia cases. The remedies that exercise a favorable effect in serous pleuritis in general are opium, quinine, and the salicylates. In pneumococcic pleurisy, the salicylates are to be eschewed owing to their depressing action. Opium may be resorted to during the early stage of the primary disease, pneumonia, to relieve the pains of a complicating pleuritis, but it should not be employed during the advanced periods, when the bronchi contain secretory products, since it dries these, thus favoring their accumulation rather than their removal. It is seldom necessary to continue this remedy after the second day. I have had considerable experience of the use of quinine in serofibrinous pleuritis complicating pneumonia, and feel strongly that it possesses a limited value, both as a supportive agent and in mitigating the serous inflammation. It is my custom to administer the drug in 4-grain doses, in capsule, followed by a few drops of dilute hydrochloric acid to insure its prompt solution, three or four times daily.

Local measures may prove serviceable in selected cases. Counter-irritation by means of sinapisms is to be advised in the milder forms of associated pleuritis that may accompany pneumonia, and the same is true of cold applied in the form of an ice bag or ice-water bag. If the pain be severe, we may follow the excellent suggestion of Roberts, and keep the inflamed structures at complete rest by mechanical fixation of the side affected. "For this purpose, strips of adhesive plaster must be firmly and evenly applied to the chest; they should be removed during the stage of effusion."

The *treatment of an empyema*, whether a complication or sequel of pneumonia, is surgical. If the condition develop on the side of the pneumonia from the third to the seventh day of the illness, it is well to postpone exploratory operation or resection of a rib until resolution of the lung has progressed considerably, when, however, free and permanent drainage should be promptly established. On the other hand, if the exudate be massive, and, as a consequence, the adjacent organs, particularly the heart, be markedly displaced, then aspiration

must be immediately performed, to be followed by a more radical operation at an appropriate period of the affection. It is to be recollected, however, that even a slight degree of shock is ill-borne prior to the time of occurrence of the crisis in pneumonia, and it is for this reason that operation should be delayed until early convalescence, except under the conditions previously mentioned.

It is not my desire to discuss at length the question of the advantages of mere incision and drainage as compared with those of the Eslander operation or complete resection. I have, however, time and again, witnessed a speedy termination in recovery, both from mere aspiration of the thorax, and incision and drainage without resection of a rib in empyema, occurring as a sequel of pneumonia, most commonly in young children. On the other hand, it is the safer rule to resort to rib resection in cases of pneumococcic empyema. These patients demand an abundance of fresh air, and hence should, if practicable, be placed out of doors, or, at all events, in a highly ventilated apartment. They also demand vigorous feeding with highly nutritious forms of nourishment.

Of medicines, personal observation and experience of the use of the tincture of the chloride of iron in somewhat massive doses enables me to speak confidently of its apparent efficacy in some cases of empyema, at least.

THE USE OF THE SOY BEAN AS A FOOD IN DIABETES.

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THE soy bean (*Glycine hispida*), sometimes incorrectly called the soja bean, is an annual leguminous plant which originally grew in a wild state from Cochin China to the south of Japan and to Java. It has been cultivated from the very earliest times in Japan and in China, long before the time of Confucius. Notwithstanding its extensive use in China and Japan the bean has spread but slowly to other lands. It gradually found its way into India and was brought to Europe somewhat over one hundred years ago where it was grown in the botanic gardens chiefly for show. From Egasse¹ we learn that Koempfer, who traveled extensively through the East,

¹ Bulletin général de thérapeutique, 1888, cxv, 433.

saw the soy bean in Japan and was struck by the numerous uses to which it was put. He described it in 1712 under the name of daidsu. Linnaeus described it under the name of *Dolicho soja*, and it has been described and figured by numerous other writers among whom may be mentioned Moench, Jackquin, Bentham and Hooper, Siebold and Fuccarini, Mikquel and others. In 1854 Montigny, one of the French consuls in China, pointed out the great importance of the bean, and in 1855 an attempt was made to introduce it into France under the auspices of the Société d'acclimatation. It was introduced into England about 1790, but no studies were made of its value from an economic standpoint. In 1875 Haberlandt² began a series of investigations in Austria-Hungary, and he was a most enthusiastic advocate of the use of the bean. He published a book on the subject in 1878 urging its use as a food both for man and animals.

The soy bean has been known in the United States for many years. As early as 1829 Thomas Nuttall³ wrote an article concerning the bean as a valuable crop for this country. The Perry expedition to Japan in 1853 also brought back the beans, but, until the last fifteen or twenty years, the plant has been known only as a curiosity. Recently studies have been made in various agricultural experiment stations, most notably those of Kansas and Massachusetts, and since 1898 the Office of Seed and Plant Introduction of the United States Department of Agriculture, has taken up the work of distributing the bean. In America the plant is grown chiefly as a forage crop and very little attention has been paid to its use as food for man.

The plant itself is an erect annual with branching stems covered with short hairs. The leaves are trifoliate and more or less hairy, and the flowers are violet or pale lilac in color. The pods contain from two to five seeds, and the different varieties of the bean vary in size, shape, color and in the length of time they take to mature. Some are whitish, some yellow, some greenish-yellow, some brown and some black. In shape some are spherical and some are more or less compressed. The plant varies from 2 to 4 feet in height and bears a remarkable number of beans. The flowers are self-pollinated which makes the yield independent of insects. Ordinarily the plant grows best in the same temperature as corn, but the different varieties differ in the length of time they take to mature, and the more rapid varieties may be grown in the North. Seven different varieties are handled by seedsmen and some twenty-two distinct varieties are known, while in China and Japan almost every village is said to have its own strain of soy beans. The plant assimilates free nitrogen from the atmosphere and under favorable circumstances develops nodules on the roots like many other legumes. The bean should be

² The Soy Bean, 1878.

³ New England Farmer, 1829.

harvested early as the pods open spontaneously and, if allowed to stay on the plants, scatter the beans on the ground. The ordinary variety ripens in from seventy-five to ninety days.⁴

The bean has been put to many uses. It is grown for silage and as a hay crop, and is used to improve the quality of the soil. The bean has been used as food for animals, especially cows and pigs. Some varieties contain large quantities of oil which is used as a food and for illuminating purposes, as a lubricant, and also for the manufacture of paint and soap. The residue left after the oil has been expressed may be used as fertilizer and also as food for animals.

The beans are eaten as a vegetable, in soups, sometimes picked green, boiled and served cold with a sprinkling of soy sauce and sometimes served as a salad. The bean forms the basis of the so-called soy sauces used as condiments all over the world. In the East it is most frequently used in the form of more or less cheese-like foods that are prepared from it. Of these there are a great variety, the best known being natto, tofu, miso, yuba, and shoyu. Natto is a sort of bean cheese made by boiling the beans until they become very soft and then placing the resulting mass in a warm cellar where it ferments. Tofu is prepared by soaking the beans for about twelve hours in water and then crushing them between mill stones. They are then boiled in about three times their bulk of water and filtered. The filtrate is a white, opaque, milky liquid with a taste similar to malt; this mixture has a composition nearly the same as that of cow's milk. In the making of tofu the protein is precipitated by adding the mother liquid obtained by the manufacture of salt from sea water, the precipitate being made into cakes.

	Per cent.
Water	92.53
Protein	3.02
Fat	2.13
Fiber	0.03
Ash	0.41
Nitrogen-free extract, including carbohydrate	1.88

The large amount of nitrogen which these beans contain probably accounts for the small amount of meat and other animal food taken by the Japanese. According to the dietary studies made in Japan the nitrogen from the beans, especially if taken in a mixed dietary, is easily absorbed.

The soy beans are sometimes roasted and then used as a substitute for coffee. They are also sometimes served as a vegetable, first soaking the beans until the skins come off and then boiling them until soft and serving hot. The North Carolina Experiment Station

⁴ A full account of the plant will be found in the Farmers' Bulletin, No. 58, of the United States Department of Agriculture; and of the different varieties, in the Bureau of Plant Industry, Bulletin No. 98.

recommends the bean as a palatable vegetable and suggests that the beans be soaked until the skins come off and they be stirred until the skins rise to the surface, when it is easy to remove them. The beans are then boiled with bacon until soft, seasoned with pepper, salt, and butter, and served hot. If the beans are green the preliminary soaking may be omitted.

The soy bean meals have been analyzed by Winton and two specimens showed the following composition: One is said to contain 5.5 per cent. of starch and the other 7.63 per cent. Both specimens have essentially the same composition, showing 39.87 per cent. protein, 3.85 per cent. of fiber, 2.09 per cent. of nitrogen-free extract, 19.06 per cent. of fat, 8.95 per cent. of starch, sugar and dextrin, which is determined by the diastase method without previous washing with water and is calculated as starch, and 7.75 per cent. water. There are variations in the composition of the different varieties of beans. The yellow beans grown in America have the following composition:

	Per cent.
Water	10.13
Protein	34.63
Fat	17.98
Nitrogen-free extract	30.50
Fiber	3.69
Ash	3.07

Calculated to a water-free basis:

Protein	38.50
Fat	20.00

The following table of Pellet⁵ gives the composition of certain varieties of soy bean:

	China. I	Hungary. II	France. III
Water	9,000	10,160	9,740
Fat	16,400	16,600	14,120
Protein	35,500	27,750	31,750
Starch, dextrin, and saccharine substances.	3,210	3,210	3,210
Cellulose	11,650	11,650	11,650
Ammonia	0,290	0,274	0,304
Sulphuric acid	0,065	0,234	0,141
Phosphoric acid	1,415	1,554	1,031
Chlorine	0,036	0,035	0,037
Potassium	2,187	2,204	2,317
Calcium	0,452	0,316	0,230
Magnesium	0,397	0,315	0,435
Substances insoluble in acids	0,052	0,055	0,061
Soda, iron and mineral substances	0,077	0,104	0,247
Various organic matter	19,289	25,589	24,127
	100,000	100,000	100,000

The most striking point about the bean is the fact that it contains no starch, or, at least, a very small quantity, which is strange when one considers it resembles the various beans very closely and all

⁵ Compt. rend. de l'Académie des sciences, 1880, xc, 1177.

other varieties of beans are extremely rich in starchy materials. Stingl and Morawski⁶ explain this fact by the presence in the grain itself of a diastase possessing the property of converting starch for two-thirds into sugar and for the remaining one-third into dextrin. This ferment has a much greater power in saccharifying than any of the other forms of the same group.

The fact that the soy bean contains little or no starch suggests its use in certain diseases. One of us (Ruhräh)⁷ has already called attention to the use of the bean in infant feeding. Egasse, too, called attention to the fact that the bean may be used as an article of diet in various diseases, particularly in diabetes, and the first trials in this disease were made by Dujardin-Beaumetz at the Cochin Hospital.

As it contains no starch it is exceedingly difficult to make a bread without the introduction of a certain amount of some other flour, but Lecerf, one of the French pharmacists, is said to have made a bread which resembled somewhat ginger bread, which was not at all disagreeable, and which contained no starch whatever or a very small percentage. Lailleux is said to have treated a number of cases of diabetes in Algiers with the soy bean with admirable results. Our own experience with the soy bean in diabetes extends over a series of eight cases. As we shall attempt to show, there can be no question that this bean may be of the greatest value to the diabetic; for when we observe the rather limited diet to which the diabetic patient is restricted, any addition to his dietary must be greatly welcomed. This is especially true of a food free of starch, and containing much protein as is found in the soy bean, which may be utilized in the body in place of that of other vegetables and of meats. The beans may be taken as a vegetable by soaking them for about twelve to sixteen hours, until the skins come off, stirring until the skins rise to the surface and can be removed, and then boiled in salt water or with bacon until soft, and seasoned with pepper, salt, and butter, and served hot. When the bean is not available the gruel flour from the soy bean is even more serviceable. An analysis of this flour yielded the following results:⁸

	Per cent.
Protein N. X. 6.25	14.64
Fat	19.43
Mineral matter	4.20
Moisture	5.26
Crude fiber	2.35
Cane sugar	9.34
Non-nitrogenous extract	14.78
Starch	None
Reducing sugars	None
Polarization normal weight due to optically active substance other than cane sugar included in proteins and non-nitrogenous extract . . .	7.86 ⁹

⁶ On the Nature of the Sugar of the Soy Bean, Monatshefte für Chemie, 1887, viii, 82.

⁷ The Soy Bean in Infant Feeding, Archives of Pediatrics, July, 1909.

⁸ Manufactured by the Cerec Co., Tappan, N. Y. Ruhräh, Journal of the American Medical Association, 1910, lv, 1664.

	Water.	Fat.	Protein.	Nitrogen.	Starch, dex- trine, sugar.	Cellulose.	Various organic substances.	Non-nitro- genous organic substances.	Ash.	Observations.
{ Beans from Hungary	6.94	13.71	38.29	....	....	5.33	....	26.20	4.36	
{ Yellow beans from China	7.84	17.10	32.15	....	....	4.53	....	32.91	5.42	
{ Chinese variety	7.96	16.21	31.26	....	....	4.57	....	34.59	5.23	
{ Red-brown beans	7.46	17.45	32.26	....	....	5.31	....	31.78	4.46	
{ Red brown . . . . .	....	17.50	36.12	5.78	....	....	....	....	....
{ Yellow . . . . .	....	18.26	35.87	5.76	....	....	....	25.56	....
Cupan	14.00	16.76	32.22	4.76	....	5.57	....	....	....
{ Sample from China	9.00	16.40	35.5	....	3.21	11.65	19.29	....	4.86	
{ Sample from Hungary	10.16	16.6	27.75	....	3.21	11.65	25.59	....	4.87	
{ Sample from Etampes	9.74	14.12	31.75	....	3.21	11.65	24.13	....	5.15	
Muntz . . . . .	....	17.60	36.67	....	6.40	....	....	....	....
Bulletin 15, U. S. Department of Agriculture, Office Experimental Stations, p. 390 (1890)	10.8	16.9	34.00	....	....	4.8	....	28.8	4.7	Average of 8 analyses
Ibid., dried substance . . . . .	....	18.9	38.1	....	....	5.4	....	32.2	5.3	Average of 8 analyses
Eighth Annual Report, Storr's Experimental Station, pp. 183-186, 1895. Soy flour	10.4	18.9	36.00	....	....	2.6	....	27.00	5.1	Soy flour. Average of 2 analyses
Ibid., dried substance . . . . .	....	21.00	40.2	....	....	2.9	....	30.2	5.7	Average of 2 analyses
Nikitin	7.35	20.27	42.28	....	....	4.7	....	19.63	5.77	
{ Black soy beans from Russia, 1st sample	8.43	17.86	44.75	....	....	....	....	....	5.03	
{ Black soy beans from Russia, 2d sample	7.11	18.63	38.14	....	....	....	....	....	5.06	
Lipski, yellow soy bean from Russia	9.24	17.23	37.14	....	....	9.70	....	21.89	4.78	
{ Yellow soy beans from Russia	7.80	15.41	34.12	....	....	8.86	....	29.50	4.31	
{ Yellow soy beans from China	7.21	14.78	33.27	....	....	8.95	....	31.84	3.95	
Giljaranski	6.28	13.33	29.15	....	....	11.20	....	35.74	4.52	
{ Yellow soy beans from Japan	8.16	14.79	31.10	....	....	11.08	....	30.32	4.43	
{ Black soy beans from China	8.92	16.43	35.64	....	....	9.00	....	24.76	4.15	
{ Green soy beans from Japan . . . . .	....	....	....	....	....	....	....	....	....
König, soja hispida, platycarpa, var. melanosperma Harz black	12.71	14.03	32.18	....	....	4.40	....	31.97	4.71	Average of 3 analyses
Tumida, var. pallida Harz yellow	9.89	17.68	33.41	....	....	4.67	....	29.31	5.10	Average of 25 analyses
Tumida, var. eastanea Harz brown	9.26	18.03	32.90	....	....	4.76	....	30.17	4.89	Average of 13 analyses
Tumida, var. atropurpurea Harz round black	11.23	17.11	33.97	....	....	4.55	....	28.41	4.73	Average of 5 analyses
Without indication of the botanical variety	11.34	16.98	35.11	....	....	5.88	....	26.18	4.51	Average of 17 analyses
{ White soy bean from Java	11.70	16.97	37.62	....	....	4.58	24.03	....	5.10	
{ White soy bean from China	11.40	11.80	43.50	....	....	5.12	23.10	....	5.08	
Prinsen . . . . .	....	15.29	40.12	....	....	5.36	44.00	....	5.17	
{ White soy bean from China . . . . .	....	15.29	40.12	....	....	5.36	44.00	....	5.17	
{ Débris of dried black beans . . . . .	....	21.89	33.36	....	....	5.35	....	34.18	5.22	
Goesman . . . . .	....	18.42	35.98	....	....	5.15	....	34.88	5.57	
{ 1st sample . . . . .	....	....	....	....	....	....	....	....	....
{ 2d sample . . . . .	....	....	....	....	....	....	....	....	....
Kellner . . . . .	....	20.46	42.05	....	....	4.53	28.82	....	4.19	

The percentage of protein in this flour is almost one-third greater than the percentage of protein in the whole beans. This is caused by removing the coarse fibrous hulls which contain little protein.

Vegetable food of such composition certainly is remarkable when compared with round of beef, medium, which contains:

	Per cent.
Protein	19.0
Fat	12.8
Moisture	60.7

Each ounce of this soy gruel flour yields about 13 grams of protein and 120 calories, and there are several ways in which it can be used: (1) As a gruel, (2) in broths, (3) in making biscuits. The following table shows the approximate composition and caloric value of the gruels made from the soy bean gruel flour:

Each ounce contains 13 grams protein and 120 calories.

	Protein, per cent.	Fat, per cent.	Sugar, per cent.	Calories.
$\frac{1}{2}$ ounce, 1 level tablespoonful to quart	0.35	0.15	0.08	30
$\frac{1}{2}$ ounce, 2 level tablespoonfuls to quart	0.70	0.30	0.15	60
$\frac{3}{4}$ ounce, 3 level tablespoonfuls to quart	1.0	0.45	0.23	90
1 ounce to quart	1.4	0.60	0.30	120
2 ounces to quart	2.80	1.20	0.60	240
3 ounces to quart	4.20	1.80	0.90	360
4 ounces to quart	5.60	2.40	1.20	480
5 ounces to quart	7.00	3.00	1.50	600
6 ounces to quart	8.40	3.60	1.80	720
7 ounces to quart	9.80	4.20	2.10	840
8 ounces to quart	11.00	4.80	2.40	960

COOKING DIRECTIONS. *Gruels.* A quart of gruel is made by boiling from 1 level tablespoonful to 6 ounces of the soy gruel in one quart of water for fifteen minutes, adding water to make up for loss by evaporation. Salt should be added to taste.

	Protein.	Fat.	Carbohydrates.
1 level tablespoonful to quart	0.35	0.15	0.08
1 ounce 4 tablespoonfuls to quart	1.40	0.60	0.30

These gruels do not thicken during cooking as they contain no starch, and readily settle on standing. This may be overcome by adding 1 to 2 heaping teaspoonfuls of barley, oat or wheat gruel flour before cooking, which will add 0.6 per cent. to 1.2 per cent. starch to the gruels, and also slightly increase the percentage of protein.

Broths: Add 1 to 8 ounces of the flour to one quart of beef, mutton, veal or chicken broth and boil for fifteen minutes, adding water to make up for loss of evaporation; or, boil the same quantity of the soy flour for one hour with one quart of water, to which has been added a piece of ham, bacon, or salt pork to give flavor. Each ounce of the flour will add to the broth about 13 grams of protein and 120 calories, or in percentage add 1.4 per cent. protein, 0.60 per

cent. fat and 0.30 per cent carbohydrates. A broth made with 6 ounces of the soy flour to the quart would be half as rich in protein and fat as steak.

Muffins. To make muffins from the soy flour, take $1\frac{1}{4}$ teacupfuls of the soy flour, $\frac{1}{4}$ teacupful of wheat flour, $\frac{1}{2}$ teaspoonful of salt, 2 eggs, 1 teacupful of sweet milk, 2 rounded teaspoonfuls of baking powder, and $1\frac{1}{2}$ tablespoonfuls of melted, but not hot butter. Beat well together, adding the melted butter last, and bake in gem pans in a hot oven. This will make about twelve muffins which will contain about 150 grams of protein and which will yield about 1800 calories of which the carbohydrates produce but 280. In as much as the soy flour contains no starch the addition of some wheat flour in making muffins is required. The mixture of wheat and soy flour in this formula will contain about 36 per cent. protein and 20 per cent. carbohydrates, against 14 per cent. protein and 60 to 70 per cent. carbohydrates in gluten flour. The proportion of protein to carbohydrates is eight to ten times as large in the mixed soy and wheat flour as in gluten flour.⁹

In the study of our 8 cases of diabetes, the patients were placed first, upon an unlimited diet; second, upon the restricted (usual diabetic) diet; and third, upon restricted diet together with the soy bean. The soy bean replaced largely the gluten of wheat bread, while the patient still remained upon the usual diabetic diet. In nearly every instance there was a marked diminution in the glycosuria. The following cases illustrate the condition:

CASE I.—K. T., male, aged forty-four years. The patient has had diabetes for two years and has lost fifteen pounds in weight. On an unrestricted diet, he passed as much as 1.5 per cent. sugar in his urine (45 grams daily). When placed on the usual diabetic diet with gluten bread the amount of sugar was diminished to 1.1 per cent. (30 grams daily). When placed, however, on the usual diabetic diet without gluten bread, but with the addition of the soy beans, the amount of sugar in the urine was diminished to 0.9 per cent. (20 grams daily).

Observation.	Daily quantity of urine in c.c.	Specific gravity.	Per cent. sugar.	Total quantity sugar per day (grams).
1. Unlimited diet	2955	1038	1.5	45
2. Diabetic diet	2050	1032	1.1	30
3. Diabetic diet + Soy beans	2065	1028	0.9	20

CASE II.—M. F., female, aged forty-nine years. The patient has had diabetes for five years and has lost 22 pounds in weight. On an unrestricted diet she passed as much as 3.5 per cent. of sugar in her urine (90 grams daily); on an ordinary diabetic diet the sugar

⁹ Ruhräh, The Soy Bean as an Article of Diet for Infants. (These directions have been published in the Journal of the American Medical Association, 1910, 1v, 1664.)

was diminished to 2.1 per cent. (48 grams daily); on the usual diabetic diet together with the soy beans the amount of sugar in the urine was diminished to 1.5 per cent. (31 grams daily).

Observation.	Daily quantity of urine in c.c..	Specific gravity.	Per cent. sugar.	Total quantity sugar per day (grams).
1. Unlimited diet	2570	1032	3.5	90
2. Diabetic diet	2250	1030	2.1	48
3. Diabetic diet + soy beans . .	2030	1024	1.5	31

CASE III.—T. H., male, aged fifty-four years. The patient has been suffering with diabetes for one and a half years, and has lost twelve pounds in weight. On an unrestricted diet, he passed as much as 3.2 per cent. of sugar in the urine (92 grams daily); on an ordinary diabetic diet the sugar was diminished to 2.5 per cent. (58 grams daily); on the usual diabetic diet together with soy beans the amount of sugar in the urine was diminished to 2 per cent. (40 grams daily).

Observation.	Daily quantity of urine in c.c.	Specific gravity.	Per cent. sugar.	Total quantity sugar per day (grams).
1. Unlimited diet	2910	1038	3.2	92
2. Diabetic diet	2320	1032	2.5	58
3. Diabetic diet + soy beans . .	2000	1032	2.0	40

CASE IV.—J. N., male, aged fifty-one years. This patient has had diabetes for four years and has lost eighteen pounds in flesh. On an unrestricted diet he passed as much as 3.5 per cent. of sugar in his urine (94 grams daily). When placed on the usual diabetic diet with gluten bread, the amount of sugar was diminished to 2.4 per cent. (50 grams daily); on the usual diabetic diet without gluten bread, but with the addition of soy beans, the amount of sugar in the urine was diminished to 2.1 per cent. (43 grams daily).

Observation.	Daily quantity of urine in c.c.	Specific gravity.	Per cent. sugar.	Total quantity sugar per day (grams).
1. Unlimited diet	2750	1032	3.5	94
2. Diabetic diet	2090	1026	2.4	50
3. Diabetic diet + soy beans . .	2020	1026	2.1	43

CASE V.—R. N., female, aged forty-five years. This patient has had diabetes for two years and has lost ten pounds in flesh. On an unrestricted diet she passed as much as 2.2 per cent. of sugar in her urine (58 grams daily). When placed on the usual diabetic diet the urine became sugar free, and on the usual diabetic diet with the addition of soy beans, the urine still remained sugar free.

Observation.	Daily quantity of urine in c.c.	Specific gravity.	Per cent. sugar.	Total quantity sugar per day (grams)
1. Unlimited diet	2620	1026	2.2	58
2. Diabetic diet	2000	1020	0	0
3. Diabetic diet + soy beans	2000	1022	0	0

CASE VI.—S. K., female, aged forty-nine years. This patient has had diabetes for eight and one half years, and has lost twenty-six pounds in flesh. On an unrestricted diet she passed as much as 4.1 per cent. of sugar in her urine (132 grams daily). When placed on the usual diabetic diet with gluten bread the amount of sugar was diminished to 3 per cent. (75 grams daily); on the usual diabetic diet without gluten bread, but with the addition of soy beans, the amount of sugar in the urine was diminished to 2.5 per cent. (54 grams daily).

Observation.	Daily quantity of urine in c.c.	Specific gravity.	Per cent. sugar.	Total quantity sugar per day (grams)
1. Unlimited diet	3200	1038	4.1	132
2. Diabetic diet	2500	1034	3.0	75
3. Diabetic diet + soy beans	2150	1026	2.5	54

CASE VII.—W. T., male, aged fifty-eight years. The patient has had diabetes for five years and has lost eight pounds in flesh. On an unrestricted diet he passed as much as 3.8 per cent. of sugar in his urine (122 grams daily). When placed on the usual diabetic diet with gluten bread the amount of sugar was diminished to 3.1 per cent. (93 grams daily); on the usual diabetic diet without gluten bread, but with the addition of soy beans, the amount of sugar in the urine was diminished to 2.6 per cent. (63 grams daily).

Observation.	Daily quantity of urine in c.c.	Specific gravity.	Per cent. sugar.	Total quantity sugar per day (grams).
1. Unlimited diet	3200	1040	3.8	122
2. Diabetic diet	3000	1038	3.1	93
3. Diabetic diet + soy beans	2400	1036	2.6	63

CASE VIII.—N. G., male, aged sixty years. The patient has had diabetes for twelve years, and has lost nineteen pounds in flesh. On an unrestricted diet he passed as much as 4.3 per cent. of sugar in his urine (143 grams daily); when placed on the usual diabetic diet the amount of sugar was diminished to 3.4 per cent. (79 grams daily); on the usual diabetic diet with the addition of soy beans, the amount of sugar in the urine was diminished to 1.9 per cent. (40 grams daily).

Observation.	Daily quantity of urine in c.c.	Specific gravity.	Per cent. sugar.	Total quantity sugar per day (grams).
1. Unlimited diet	3400	1038	4.2	143
2. Diabetic diet	2300	1032	3.4	79
3. Diabetic diet + soy beans . .	2100	1024	1.9	40

CONCLUSIONS. (1) The soy bean is a valuable addition to the dietary of the diabetic on account of its palatability, and the numerous ways in which it can be prepared. (2) The soy bean in some way causes a reduction in the percentage and total quantity of sugar passed in diabetic subjects on the usual dietary restrictions.

THE ROLE PLAYED IN AUSCULTATORY SIGNS OF THE RESPIRATORY SYSTEM BY THE SOUND-CONDUCTING PROPERTY OF THE BONY FRAMEWORK OF THE THORAX.

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In this preliminary communication, I desire to call attention to certain findings relative to the conduction of auscultatory sounds by the bony framework of the chest. In my perusal of the literature on the subject,¹ I find no positive references that the observations here noted have been previously made.

The first observation is, that typical bronchial breathing may be heard at the acromion end of the clavicle. By placing the bell of the stethoscope (a bell of about the size used on the Ford stethoscope) over the acromion end of the clavicle, and having the patient make deep respiratory efforts, typical bronchial breathing will be heard. When auscultating over a small clavicle, it will, at times, be necessary to draw the skin up around the bell to eliminate external sounds. Not only is bronchial breathing heard, but the spoken and whispered voice sounds are transmitted clearly.

These auscultatory findings are present in nearly all chests and are heard especially well in those persons who do not have a thick subcutaneous and fatty covering. In the normal individual they

¹ Standard text-books by: Anders, Physical Diagnosis; Bonney, Pulmonary Tuberculosis and its Complications; Bulter, Diagnosis of Internal Medicine; Cabot, Physical Diagnosis; Da Costa, Physical Diagnosis; Guttman, Diagnosis; Greene, Medical Diagnosis; Leube-Salinger, Special Medical Diagnosis; Loomis, Physical Diagnosis; Musser, Medical Diagnosis; Sahli-Kinnicutt and Potter, Diagnostic Methods; Wilson, Diagnosis; and The Index Catalogue of the Surgeon General's Library and the Index Medicus from 1896 to 1910; many of the general articles on Physical Diagnosis, particularly those in American Journals.

are usually heard with more distinctness on the right side than on the left; the reason for this will be referred to later.

From our knowledge of the anatomical relations, we know at once that beneath the acromion end of the clavicle, there is no pulmonary tissue; therefore, whence the sound? A moment's reflection makes it clear that the sound must be transmitted through the clavicle and by bone conduction. Evidently, the sounds created by the tracheal vibrations are taken up by the manubrium sterni and by the sternal ends of the clavicular articulation. The intensity of these sounds, as we hear them, is dependent primarily upon the proximity of the trachea to the upper portion of the anterior thoracic wall, then upon the sound condensing power of the underlying lung, and then upon the accuracy with which we can approximate the stethoscope to the clavicle (Fig. 1).

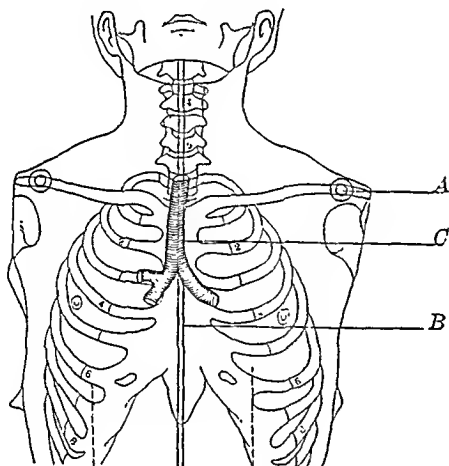


FIG. 1.—A, acromion area of bronchial breathing; B, median line of the body; C, position of the trachea as compared with the median line of the body. (J. C. Blake, AMER. JOUR. MED. SCI., 1899.)

Another observation by which we can easily demonstrate the simple truth of this sound-conducting property of bone to points distant from their origin is afforded by the upper cervical vertebrae and the bones of the cranium. From the illustrations given in textbooks on physical diagnosis we are led to believe that the bronchial breathing on the back of the spinal column ends at about the sixth cervical vertebra, at the level of the larynx. As a matter of fact, however, this sound is transmitted as high up along the spine as the stethoscope can be closely applied. Very often the bronchial sound is transmitted to, and may be distinctly heard by applying the stethoscope over the occipital and other bones of the cranium. It may also frequently be heard below the fifth dorsal vertebra which we have always been told is the lower boundary of bronchial breathing (Fig. 2).

These observations, then, prove conclusively that the bony framework of the chest is capable of transmitting auscultatory signs from points near their source of origin to distant points on the contour of the chest. We have in this fact a basic principle to consider in the interpretation of sounds heard over the various portions of the thorax, in health and in disease.

The application of the principle here involved will lead us toward the explanation of sounds hitherto not explained, and to the better explanation of certain sounds which supposedly were understood. Among those are the following:

Bronchovesicular Breathing, and Increased Vocal Fremitus and Resonance Over the Right Apex. A most admirable study of the origin of increased vocal fremitus and resonance over the right apex has been made by Fetterolf.² He summarizes the previous explana-

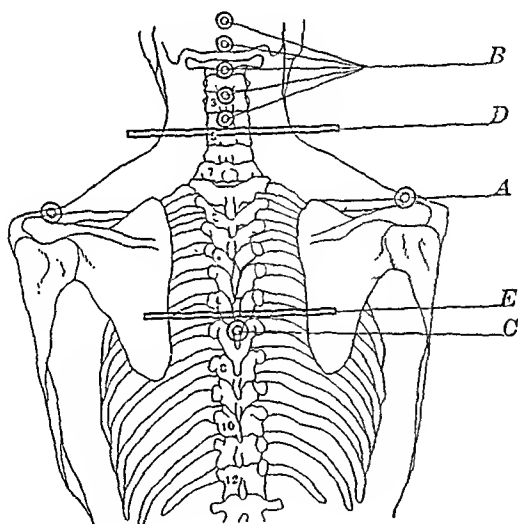


FIG. 2.—A, bronchial breathing heard over the acromion area; B, bronchial breathing heard above the recognized height; C, bronchial breathing heard below the recognized height; D, level of the fifth cervical vertebra where bronchial breathing is supposed to end; E, level of the fifth dorsal vertebra where the bronchial breathing is supposed to end.

tions of the causation of this into three views. (1) That it is the result of the more direct continuation of the right bronchus into the line of the trachea; (2) that there is a shorter distance from the bifurcation of the trachea to the right apex; and (3) that the right bronchus is of greater caliber. These three views he discards and in their place offers his own as based upon anatomical study. Fetterolf believes that the increased vocal fremitus and resonance of the right apex are due to the fact that on the right side the lung tissue proper comes in direct contact with the bronchus, whereas, on the left side there is about 3 cm. of other tissues interposed between

² The Anatomical Explanation of the Greater Amount of Vocal Fremitus and Vocal Resonance Normally Found at the Apex of the Right Lung, Arch. Int. Med., February, 1909.

the bronchus and lung tissue. The illustrations in his monograph show that the trachea is situated distinctly to the right of the median line.

By careful auscultation beginning at the manubrium sterni, I find that the tracheal tone or "bronchial breathing" extends further and is heard more clearly to the right than to the left of the median line. It is also true that the bronchial breathing heard over the acromion end of the right clavicle is better transmitted and is louder than that on the left side. The natural reason for this increased sound is the normal position of the trachea, which is almost entirely to the right of the median line.

Correlating the preceding facts, I may then offer the following explanation: The trachea, because of its proximity to the thoracic wall and lying to the right of the median line, imparts more sound vibrations to the right half of the upper part of the sternum, right clavicle, and first two ribs; these by their property of sound conduction transmit the "bronchial" element across that portion of the chest wall which covers the apex of the right lung. The sound emanating from the healthy lung apex is vesicular, while that transmitted by the bony framework is "bronchial." Heard together, they give rise to what has been designated as broncho-vesicular breathing. I believe this to be the predominating factor in the true explanation of the bronchial elements heard over the right apex. In round chests, in which the trachea is deep set and scarcely comes in direct contact with the anterior thoracic wall, the bronchial element in the breath sounds over the right apex, and the bronchial breathing at the acromion ends of the clavicles may be barely audible. A thick layer of subcutaneous tissue may also render these sounds quite imperceptible.

Bronchial Breathing without Dullness to Percussion. Especially in normal chests of slender adults and in children, we quite frequently hear distinct bronchial breathing at points a considerable distance from the previously recognized areas of normal bronchial breathing; that is, areas overlying the normal position of the trachea or bronchi. These are examples of transmitted bronchial breathing by bone conduction.

At the Acromion Area, I have found the sounds exaggerated when the apices were consolidated from pneumonia or tuberculosis. Moist tracheal rales, such as may be heard in any ordinary case of tracheo-bronchitis, or in pulmonary oedema, are distinctly transmitted to the acromion area, the clavicle acting merely as a conductor of the sound waves that are imparted to it.

There are, undoubtedly, a number of other instances of transmitted sound conduction by the bony framework of the chest, and some of these are under investigation now.

On considering the importance attached to bronchial breathing

in both acute and chronic pulmonary diseases, one realizes how necessary is its proper interpretation as to its point of origin.

Other positive evidences of pulmonary consolidation must be present before we may say that the lung beneath the area of auscultation is more dense than normal.

The underlying principle involved in these observations is in complete harmony with the general law of physics: that the more dense the medium, the better conductor it is of sound waves.

A CLINICAL METHOD OF ESTIMATING THE COAGULATION TIME OF THE BLOOD.

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MANY different methods have been employed for estimating the coagulability of the blood. In all these methods no attempt is or can, of course, be made actually to measure the time or extent of the coagulation of the blood when this is surrounded by normal tissues and is circulating in a normal manner, for under such circumstances it does not coagulate at all. The aim is always the testing of the coagulability of the blood under certain unnatural surroundings, and as these surroundings differ in different methods, the results obtained can only be compared in the most general way. Thus, by one method, healthy blood may coagulate in two minutes and by another in fifteen, and yet by each method the conclusion may be arrived at that the coagulation time is normal.

Among the various methods which have been advocated for the measuring of the coagulation time of the blood some, such as that of Brodie and Russell¹ and especially Addis' modification of it,² appear to give very constant results, but such apparatus is too complicated and elaborate for ordinary clinical use. Among the simpler clinical methods probably that of Wright has been used more widely than others, but in the hands of different observers has given very inconstant results. His method consists in filling several fine glass tubes with blood and keeping these at a temperature of 37° C. in a vessel of warm water, and then at intervals blowing out the contents of each tube until one is found to have coagulated. With this method coagulation occurs normally in about two minutes, and in abnormal conditions is said to occur in thirty seconds or even less. Many men find the method to give reliable results, but an objection which

¹ Jour. Phys., 1897, xxi, 403.

² Quar. Jour. Exper. Phys., 1908: i, 4; Brit. Med. Jour., 1908, i, 997.

naturally arises is that the whole operation is so quick that any delay in manipulation would markedly change the findings. Thus Addis says that it took him nearly thirty seconds to fill the tubes and introduce them into the water bath. Turner³ made over 1000 observations with the method, and while his average coagulation time was two minutes and forty seconds, he says that differences of *two* minutes occurred in the time of the same individual in successive punctures. Many other methods have been introduced for clinically measuring the coagulability of the blood; a mere list would be of no value, and is therefore omitted.

In 1904 Sabrazés published a method of using fine glass tubes which were filled with blood and then broken across at half-minute intervals and the broken ends slowly separated. When a thread of fibrin appeared between the broken ends coagulation was said to have occurred. In 1906 Geneuil⁴ published a thesis on coagulation of blood, in which he used Sabrazés' method extensively. J. P. McGowan⁵ advocated the same method (as regards the use of glass tubes); and it has been with tubes as made in Edinburgh for McGowan that we have worked. Addis, who has written extensively upon the subject of coagulation, in reviewing the different methods, came to the conclusion that the end-point adopted here, that is, the moment when a thread of fibrin appears between the broken ends of the tube, is freer from error of technique than any other of the simpler methods employed. He found in a series of 256 estimations that the average difference in the coagulation time in each of tubes filled at the same time and kept under the same conditions was thirty seconds, and as the average time of coagulation was eight minutes, the margin of error was small. Our results fully bear out this finding. Sabrazés kept his tubes in an apparatus consisting of two glass boxes, the lower of which contained hot water or ice, and the upper one the tubes and a thermometer. He says that if the temperature in the upper chamber be too high, one may lift the upper vessel so as to let in cool air, or carry it to an open window; if, on other hand, it be too low, the lower chamber may be heated with a lamp. The lid had to be taken off every time a tube was removed for breaking, so that the keeping of the tubes at a constant temperature seems full of difficulties. McGowan used no apparatus for maintaining the temperature at one point, and says that while for accurate work the tubes may be kept near a thermometer, for clinical purposes a temperature between 15° and 20° C. does not matter. This, as will be shown later, is very misleading, as, roughly speaking, each degree Centigrade between 15° and 20° makes a difference of about one minute in the coagulation time.

³ Jour. Mental Science, January and October, 1907.

⁴ Bordeaux Thesis, 1905-06.

⁵ Brit. Med. Jour., 1907, ii, 1580.

Addis, finding that the maintaining of a constant temperature was so important, introduced a thermostat for this purpose. We have used the apparatus considerably, and find that it does this, but is of bulky size; moreover, in our hands is inconvenient in that the tubes must be put into the apparatus vertically through very small holes, and hence must be first sealed, which takes considerable time—during which they are exposed to the room temperature. However, Addis, using the apparatus, got results that were very constant, and with which our findings closely correspond.

During the first four hundred or so estimations we used no apparatus to keep the temperature the same, but the tubes after being filled were laid alongside of a thermometer and kept there until the end of the experiment. The results were then plotted out on a chart in order that one might by reference to this chart judge of the probable clotting time in any further given case. And this method may be useful for rough clinical work, but for more accurate work and for comparing a case's condition from time to time it is much better always to work at one temperature, and this may be conveniently done by using a simple apparatus which consists of the following parts:

Apparatus and Method. Thin glass tubes 1.5 mm. in diameter and about 7 inches in length are used. A pint *Thermos* bottle is employed, and its ordinary cork is replaced by a rubber cork perforated in three places. In these perforations rest two brass tubes, 7 inches long and just large enough in caliber to hold easily the glass blood tubes. The third perforation in the cork contains a thermometer. The apparatus rests on its side on a special stand, which prevents it rolling about. The bottle is filled with water at the temperature at which it is desired to work, say 20° C., and the cork is put in position. The temperature of the contents will remain for fully an hour at the same point in a room of 55° F. or more.

The back of the finger or thumb near the nail is cleansed with soap and water and then with alcohol. As soon as it is dry the digit is wrapped about with a piece of twine loosely and at once punctured, the exact time of puncture being noted. Two glass tubes are partially filled from the same drop, the blood being made to run nearly to the far end of each, and each as filled is placed in a brass tube of the thermostat, the first in that to the left and the other in that to the right. Then the protruding ends, which are the ends at which the blood entered the tubes, are sealed at one's leisure with a spirit lamp. If the test is being made upon an apparently healthy individual, in about five minutes the first tube is drawn out of its holder by the left hand (which is covered with a thick glove, in order that the heat of the fingers may less affect the tube) and touched with a glass-file and broken across between one's fingers and thumbs, and the broken ends are slowly separated. Probably the

blood column also breaks across sharply, if one may so speak of a column of fluid. The tube is at once replaced in the thermostat. In half a minute the second tube is removed and treated in the same way. Soon on breaking the tube across and separating the ends a thread of fibrin appears between the broken ends. At once the tube is broken farther on, and probably the thread of fibrin again appears. Very rarely a thread appears at the first break and not at the next one. This would be counted as a negative finding, and the tube would at once be replaced in the thermostat and tried again in fifteen seconds. If one be careful to begin the breaking at the first blood which entered the tube, such a thing seldom happens. One of the alternating tubes having given a positive finding, the other one almost certainly will do so in the next half minute, but if not, then usually in the next. With quick working one can try them every quarter of a minute, but the half minute intervals give more time to make sure that a given tube has really coagulated, as it can be broken several times before the next one is due.

More recently we have been confining our attention to tube No. 1, and only when it shows a coagulum do we try No. 2 as a control. This change was made at Professor Brodie's suggestion, as the first tube can be more accurately timed and also contains the more normal blood, as the later the blood flows from the wound the more readily does it coagulate. This was shown by Addis, who found that at 18.5° C., using his special apparatus, the blood which first flowed from a puncture coagulated in seven minutes and fifteen seconds, while that drawn from the same wound a minute later took five minutes and fifteen seconds, and after two minutes the blood coagulated in three minutes and forty seconds. Similarly we found that at 20° C. the blood from the first drop coagulated in nine minutes, and that from the same wound two minutes later in five minutes and forty-five seconds. Of course, the wound had been carefully wiped dry and clean before the second drop was taken. On another occasion under similar circumstances the respective readings were eight and five minutes for the first and second drops at two minutes' interval. The blood must flow easily from the puncture, as we find that any squeezing of the part produces a blood that coagulates with greater speed. The blood that first flows from the wound is always used, and the tubes are filled as rapidly as possible. It is easy after a little practice to have both tubes filled and safely in the thermostat within thirty seconds of the time of puncture.

The so-called McGowan tubes are 1.5 mm. in diameter, and these are what we have worked with; but Addis and Sabrazés used tubes of 1 mm. only, and their readings are about a minute faster than ours. Sabrazés states that slight variations in the size of the tubes (between 0.8 and 1.2 mm.) makes no appreciable difference in the results, and again and again we have selected the largest and smallest tubes from a lot and have found them to give practically the same readings.

The temperature of the room in which the experiment is carried out seems to have a slight influence in the results, and when the thermostat is at, say, 20° C. one looks for a slightly longer reading in a cool than in a warm room. This is probably accounted for by the cooler condition of the tubes before use, the finger punctured, the glove worn by the operator, etc. To lessen the influence of the first source of error here, we place the tubes in the thermostat for about a minute before using them in a cool room.

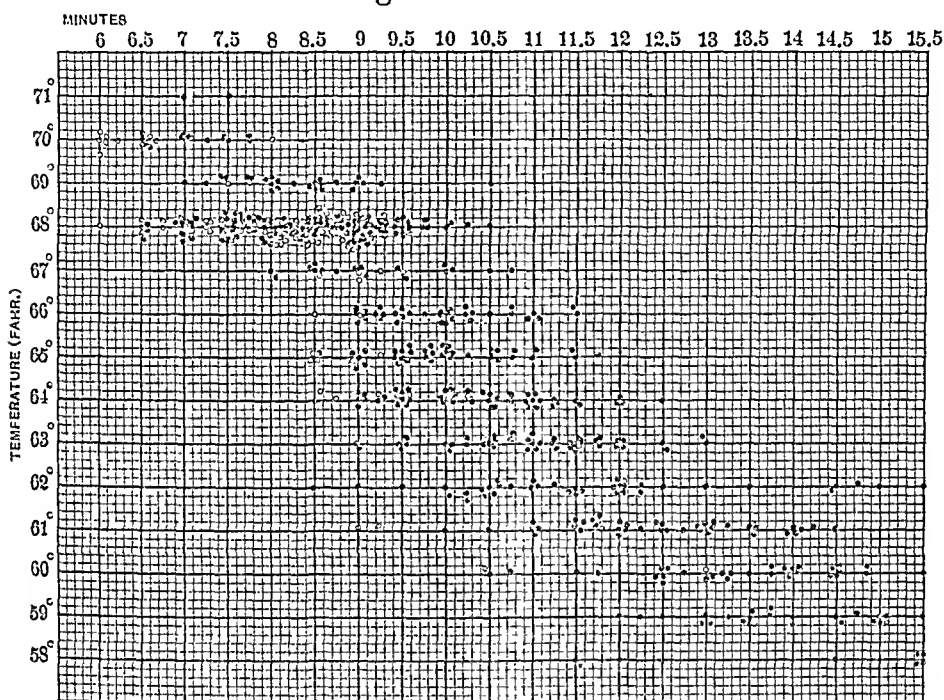


Fig. 1.—605 coagulation measurements. The solid dots represent measurements of the author's blood, and the circles, those of other healthy individuals.

The temperature at which the tubes are kept during the experiment has a most marked influence upon the coagulation time, and one must absolutely disagree with McGowan when he states that "for clinical purposes the providing of an apparatus for keeping the blood at a uniform temperature seems to be superfluous, as from my readings done at room temperature, which varied from 15° to 20° C., there was no change in the coagulation time corresponding to the elevation or lowering of temperatures within these limits." In Figs. 1 and 2 it will be seen how greatly the temperature affects the readings. In Fig. 1 the black dots represent the writer's coagulation times, and the circles those of different apparently healthy individuals of different ages and sex. In Fig. 2 these results are averaged. They show that, roughly speaking, each degree between 15° and 20° C. (59° and 68° F.) makes a difference of about one minute in the coagulation time. As already said, for rough clinical work, with the aid of a thermometer and such charts as these, an

estimation of the coagulation time may be made and compared with the average results for that temperature.

At any given time the coagulation time of an individual, as measured by our method, varies very little, showing that the experimental error is small. It is quite unusual to find in several tests made one after the other in rapid succession with blood from the same individual that the readings vary more than one minute, and more often they come out exactly the same. But on another day, at the same hour and at the same temperature, there may be a difference of perhaps two or even three minutes from the results of the previous day. This difference is hard to explain, but undoubtedly exists. It explains how Fig. 1 shows so much variation in results. If, however, the test be done two or three times in rapid succession (which

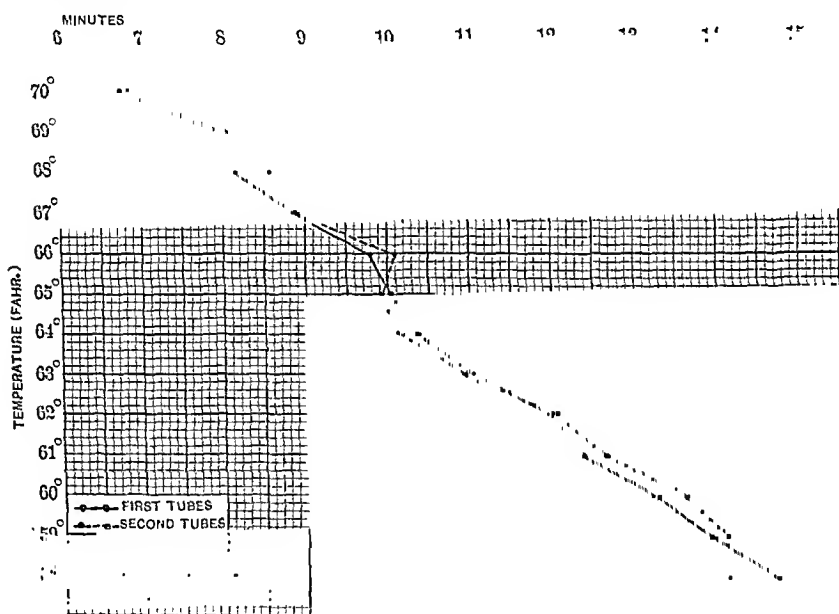


FIG. 2.—The average of the estimations shown in Fig. 1.

altogether takes less than half an hour when working at 20° C.) the coagulation of the individual for that special occasion may be very accurately gauged. Moreover, in diseased conditions very great variations occur, Sabrazés finding that with a normal of about eight minutes, at 18.5° C., cases of acute infection such as appendicitis would give a reading of two minutes and hemophilia as high as over twenty minutes. So far we have confined our observations to the apparently normal.

The age of the individual seems to make little or no difference in the time of coagulation, at 20° C. the average time of children under twelve examined being 8.04 minutes, and of adults 7.72 minutes. Sex has no evident effect, the average time of females examined being 7.54, and of males 7.76.

There has been much difference of opinion as to the presence or absence of a diurnal variation in the coagulation time of the blood, some, such as Bürker,⁶ Coleman,⁷ and McGowan, believing that such a variation exists, although they do not agree on its time of occurrence. Thus, Coleman believes that coagulation is most rapid in the morning, while Bürker and McGowan came to the opposite conclusion. Others, such as Addis, think that there is no distinct diurnal variation, and with this conclusion our results would, on the whole, agree, although possibly both in Addis' chart (dotted line in Fig. 3) and ours there does seem to be a slight average rise about two hours after a meal. Addis thinks that such is within experimental error, but it comes out in ours also at about the same time (Fig. 3).

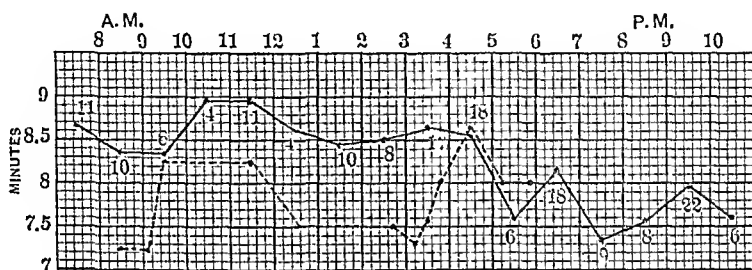


FIG. 3.—The solid line represents the average times of coagulation. All were done at 68° F. (20° C.); the broken line represents Dr. Addis' results, done at 18.5° C., using smaller tubes. The numbers denote the number of separate estimations from which the averages are compiled.

Generally speaking, a room will probably be cooler in the morning than it will be later in the day, and in any conclusions drawn from experiments in which the temperature of the tubes has not been accurately maintained at the same level (as in McGowan's), the conclusion would tend to be that the coagulation time was slower in the morning. Moreover, even when the tubes are kept in a thermostat, a cool room, as already explained, tends slightly to slow the readings. Fig. 3 shows a slight hastening of coagulation toward evening, which is probably accounted for in this way.

The relation to meals has again been much discussed, but our results give no very definite effect of food, except it be the slight slowing of coagulation about two hours after meals, already referred to. One would almost certainly expect that certain articles of diet would have an effect upon the coagulation time, but into this point we have not gone.

The temperature of normal individuals as taken by ordinary clinical methods varies between 97° and 99° F.,⁸ and this must make

⁶ Arch. f. d. ges. Phys., 1904, cii, 67.

⁷ Bio-Chemical Journal, 1907, ii, 4.

⁸ The Normal Temperature of the Body, International Clinics, vol. i, eighteenth series.

a difference in the coagulation time, but into this point we have so far not entered. If the finger punctured be cold the blood will be cooler than if the finger be warm.

The effect of the administration of calcium salts and citric acid upon the coagulation time of healthy people appears from our experience to be slight or absent. It was tried several times with each of three healthy individuals, and the average results were as follows:

Male, aged forty-four years. The average coagulation time (59 estimations) was 8.27 minutes at 20° C. He was given doses of calcium lactate varying from 20 to 60 grains, and the average coagulation time of 14 estimations made at intervals of one to several hours after the administration of the drug, was 8.56 minutes.

Female, aged twelve years. The average coagulation time (13 estimations) was 8.19 minutes. She was given calcium lactate on several occasions in doses of 10 to 30 grains, and the average coagulation time of 12 estimations made within a few hours afterward, was 8.02 minutes.

Male, aged eight years. The average coagulation time (16 estimations) was 7.9 minutes. After various doses of calcium lactate of 10 to 20 grains it was 7.87 minutes (16 estimations).

Thus, the coagulation time remained practically unaltered through all these tests.

Citric acid was tried in the same way and with results that would suggest a slight retarding action on the coagulation time of healthy persons. The same three people were tested, and the averages were as follows:

Male adult. Coagulation time before sodium citrate, 8.27 minutes; coagulation time after sodium citrate, 9.44 minutes. The drug was given in 60-grain doses.

Female, aged twelve years. Coagulation time before sodium citrate, 8.19 minutes. Coagulation time after sodium citrate, 8.75 minutes.

Male, aged eight years. Coagulation time before sodium citrate 7.9 minutes. Coagulation time after sodium citrate, 7.54 minutes. The last case showed no retarding effect, but in the other two it was decided. The doses used in the cases of the last two were 30 and 15 grains respectively, repeated.

CONCLUSIONS. 1. The chief object of this communication is to advocate and describe a method of measuring the coagulation time of the blood which is convenient clinically and which seems to give reliable results.

2. The temperature at which the experiment is carried out makes a marked difference in the results. This difference is about one minute for each degree Centigrade. At 20° C. (68° F.) the average coagulation time is about eight and one-half minutes.

3. Age (beyond early childhood) and sex seem to have no influence upon the coagulation time.

4. A diurnal variation does not seem to occur; possibly there is a slight increase in coagulability as the day advances, but this is probably due to experimental error.

5. There appears to be a slight tendency to decrease in the coagulability some two hours after a meal, but it is too slight to put much weight upon.

6. Calcium lactate does not appear to have any marked influence upon the coagulation time of the blood of normal individuals.

7. Citric acid appears to have a slight retarding influence upon the coagulation.

8. Considerable variation occurs in the coagulation time of a healthy individual from time to time, the nature of which is not evident.

I wish to express my gratitude to my colleague, Professor T. G. Brodie, for much valuable advice and assistance, both as regards the work and in the preparation of the charts.

NOTE.—Since writing this paper my attention has been drawn to two papers by K. Kottmann⁹ upon the measurement of the coagulation time of the blood. He uses a *Thermos* bottle as a thermostat, and describes two methods. One is that of Vierordt, published in 1878, with the addition of the *Thermos* bottle to regulate the temperature. The other is a new and elaborate method, in which the *Thermos* bottle is also used with the same object.

THE CLINICAL SIGNIFICANCE OF TRANSITORY DELIRIUM CORDIS.

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THE clinical studies of irregular heart action which have been reported during the past eight years have shown the great importance of the type of irregularity which has been variously designated as auricular paralysis (Mackenzie), permanent irregularity (Hering), absolute irregularity (Hewlett), and nodal rhythm (Mackenzie). The many names proposed indicate the unsatisfactory condition of our physiological knowledge of this arrhythmia, and yet the irregu-

⁹ Ztschr. f. klin. Med., 1910, lix.

larity itself has certain clinical features which distinguish it from all others. The most important of these are: (1) Its permanency in well established cases, (2) a tendency to extreme irregularity or delirium cordis, and (3) an absence of the auricular waves preceding the ventricular waves on the apex tracing, the venous pulse, the oesophageal cardiogram, and the electrocardiogram. During the past five years several writers have noted that irregularities may occur which resemble the typical permanent irregularity except for the fact that they are of a transitory character, and some of these authors believe that such transitory attacks of extreme irregularity may precede the development of the permanent form. For example, Mackenzie¹ details several case histories in which "nodal rhythm" was succeeded by normal rhythm, but later became permanent. He also describes a certain type of paroxysmal tachycardia as a transitory "nodal rhythm," but the analogy of this to typical permanent irregularity is less close than is the case in paroxysmal delirium cordis. Hewlett² mentions a case in which the permanent irregularity was preceded by what seemed to be an attack of delirium cordis. On the other hand, several authors who have described transitory delirium cordis fail to relate it to the permanent type of irregular heart action. This was true of Cushny and Edmunds,³ Fr. Müller,⁴ Bard,⁵ and Hornung,⁶ although the latter mentions a case in which the final attack lasted from October 20 to December 13, at which date the patient was discharged with his heart still irregular. It seems probable that in this case the change to a permanent irregularity had occurred under observation.

It is obvious that if transitory irregularity tends to become permanent, it is a matter of both theoretical and practical importance. Of theoretical importance, because the study of such paroxysms might be expected to throw light on the nature of the permanent form of irregularity; of practical importance, because of the necessity for a more guarded prognosis and for greater care in protecting the patient from influences which might hasten the development of the permanently irregular pulse. The criteria by which one may recognize the attacks of delirium cordis to which I wish to draw attention are: (1) Extreme irregularity, and (2) an absence of the auricular waves on the venous pulse preceding the ventricular waves. Between attacks the pulse is perfectly normal in rhythm and in the form of the venous tracing. The first of the above criteria distinguishes paroxysmal delirium cordis from paroxysmal tachycardia,

¹ Diseases of the Heart, 1908, p. 315.

² Clinical Observations on Absolutely Irregular Hearts, Jour. Amer. Med. Assoc., 1908, li, 655.

³ Paroxysmal Irregularity of the Heart and Auricular Fibrillation, AMER. JOUR. MED. SCI., 1907, cxxxiii, 56.

⁴ The Nervous Affections of the Heart, Arch. Int. Med., 1908, i, 1.

⁵ Des divers types d'arythmie cardiaque observés en clinique, Semaine méd., 1909, xxix, 49.

⁶ Ueber atypische tachycardische Paroxysmen, Deut. Arch. f. klin. Med., 1907, xci, 469.

though the two have some features in common. The second distinguishes it from irregularities due to the frequent occurrence of extrasystoles, in which a normal succession of venous waves can usually be found in many parts of an ordinary tracing.

Two of my cases (I and II) have already been reported as instances of paroxysmal irregularity; their further history is of interest in the present discussion. Five of the six were observed at the University Hospital of the University of Michigan, the other being a private case under Dr. Hewlett's care. With the exception of Case I, venous tracings were obtained during the irregular and the regular heart action in each case.

CASE I.—History of paroxysms of irregularity over many years; first tracings taken after operation; heart apparently normal between paroxysms; paroxysms very frequent and of short duration, ultimately becoming permanent; myocardial insufficiency. (Case reported by Cushny and Edmunds in 1905.)

Mrs. H., aged sixty-four years, was admitted to the University Hospital December 23, 1901, for ovarian fibroid. She was operated upon December 24. Anesthesia (ether) for one hour and twenty minutes. Her condition at the end of the operation was good; pulse beats 90 per minute with no indication of irregularity. There was persistent nausea until the 27th. On the 25th and 26th the pulse rate varied between 90 and 100, with frequent periods of irregular action, as noted by the nurse. On the 27th there were three irregular paroxysms, at 8 A.M., 2 P.M., and 8 P.M., when it was impossible to obtain accurate counts at the radial. On the 28th, and also on the 29th, frequent tracings were taken at the radial with a Jacquet sphygmograph. These showed distinct periods of irregularity, lasting in some cases only a few minutes, and then the heart suddenly would become regular again. On December 30 the nausea and vomiting stopped, with a general improvement. The irregular periods became less frequent and were confined almost entirely to the night. The patient would wake up suddenly, and the heart at once became very irregular. On January 11 the heart was very irregular during the night, but became regular toward morning, and remained so until January 18, when she was discharged. The patient reported back to the hospital that the night following her discharge the heart action was very irregular.

The tracings taken during these paroxysms of irregularity, while they lack the confirmatory evidence of the venous pulse, show a typical delirium cordis. A number of large pulsations occurred at irregular intervals, and had interspersed among them smaller pulsations, sometimes singly, at other times in twos or threes or in groups of larger numbers.

The patient stated that she first noticed the irregularity twenty years before, during an illness, and that since then it had occurred whenever she was ill, excited, or exhausted. Vomiting, to which

she was occasionally subject, was always followed by irregularity. The tendency to irregularity seemed to increase about ten years before the operation, as she observed that less important occasions would give rise to it than previously.

Examination of the heart during the patient's stay in the hospital showed no enlargement of cardiac dulness, no murmurs, and no objective signs of embarrassed circulation either during the irregular periods or in the regular intervals between. Clinically, then, nothing was found but alternating periods of regularity and irregularity, with no symptoms of heart failure during the irregularity nor any apparent lesion in the heart itself which might be responsible for this sudden inception of an abnormal rhythm.

In 1905 a letter was received from the patient stating that for two years after the operation she suffered very little from her heart, but then some overexertion gave rise to cardiac irregularity again, and for the last year very slight exertion or exposure to heat or cold has induced an attack.

The patient was seen on December 7, 1909, at which time she stated that she had been suffering from serious heart symptoms for some time, and that her heart was now continuously irregular. A few years before she had had sudden pain about the heart, and in the left shoulder, and she had since had more or less pain in both arms. She was now more or less continually short of breath, this becoming worse if she was tired or excited, and was also worse on exertion. At times the shortness of breath came on in spells. She had smothering attacks at night, at which times she felt that she could not get her breath and had to sit up. When walking, she frequently got dizzy and things became black before her face. One year before her feet were badly swollen, but this had practically disappeared. She did not take cold easily. She had gradually been losing weight and her appetite was variable.

Examination at this time showed an emaciated woman, inclined to dyspnoea on slight exertion. The apex beat was in the fifth intercostal space in about the mammary line. The right border of the heart was 1 cm. to the right of the sternal margin. There were no heart murmurs. The second sounds were of normal intensity. The heart action was very irregular. The arteries were thickened and tortuous. The liver was moderately enlarged and tender to the touch. The tracings taken on this date showed the typical features of a permanent irregularity.

CASE II.—*Mitral stenosis; first paroxysm observed after influenza; later ones induced by excitement or exertion; about seven paroxysms in five months; ultimately became permanent; numerous emboli, which finally caused death.* (Case reported by Dr. Hewlett.)

Mrs. B., aged fifty-five years, was first seen in February, 1908. Her family history was negative. She had never had acute articular rheumatism. In June, 1906, she had been treated for "heart dis-

ease," which had become so bad a month later that she had been unable to sleep in a recumbent position on account of dyspnoea. Since then she had had several breaks in compensation, with dyspnoea, cardiac distress, and at times slight oedema. In the intervals the compensation had been fairly good. When first seen, there had been an epidemic of influenza in the household, and she was suffering from the usual symptoms of this infection. In addition, she presented the typical signs of a mitral stenosis.

Examination at this time showed a pulse of 80 per minute and perfectly regular. The mitral stenotic murmur was of a marked presystolic type, with little if any rumble in early diastole. Three days later, after her temperature had fallen to normal, she complained of precordial distress, and felt unusually weak. The heart action was found to be absolutely irregular and about 102 beats per minute. The mitral murmur had completely changed its character. Its presystolic accentuation had disappeared and it was now loudest just after the second sound, and in the longer diastolic intervals it practically disappeared before the occurrence of the first sound. The following morning the heart action was again perfectly regular and 85 beats per minute, and the murmur had returned to its customary presystolic type. The precordial distress and general weakness had passed away.

In the next five months the patient had about seven of these paroxysms of cardiac irregularity, in three of which tracings were made which showed the characteristic absence of *a* waves. These attacks seemed to begin abruptly and were induced especially by emotional disturbances, that is, by seeing a dog nearly run down by a street car. Other attacks seemed to follow physical exertion. The attacks usually lasted during the day and passed off during the following night, the termination being associated with sweating. During the paroxysms the patient felt weak, short of breath on exertion, and suffered considerable distress from cardiac palpitation. Examination of the heart during paroxysms showed a slight enlargement of the cardiac dulness and the change in the diastolic murmur already described. Between attacks her venous pulse was of the normal type, with fairly prominent auricular waves.

In the latter part of May, 1909, the heart action became absolutely irregular, and the murmur permanently changed to the character it had shown during the former paroxysms. There was marked dyspnoea on exertion, with considerable cardiac distress, the general symptoms being less, however, than they were during the transient periods of irregularity. Death occurred by embolism of the abdominal aorta and gangrene of the legs.

CASE III.—*First paroxysms observed after anesthesia; heart apparently normal between attacks; occasional paroxysms for several months, after which the irregularity became permanent, and the patient showed the symptoms of myocardial insufficiency. Death.*

Mr. P., aged sixty years, entered the surgical clinic of the University Hospital on October 8, 1908, and was operated upon on the 10th for a hydrocele. Very shortly after coming out of the anesthesia he developed a marked cardiac irregularity, and was immediately transferred to the medical ward. The history which was later taken threw no light on the condition, the family and personal history being in every respect normal. Tracings showed a well-marked delirium cordis, with no "a" waves on the venous pulse (Fig. 1). During the attack the patient was obliged to sit propped up in bed in order to avoid a most distressing dyspnoea. The heart outlines during the attack differed in no respect from those present on his admission to the surgical service. There were no murmurs either at the base or apex. The first sound at the apex was faint, but distinct

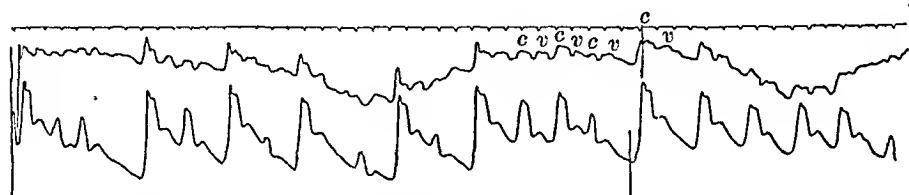


FIG. 1.—Case III. Paroxysm of irregularity on October 11, 1908. No auricular waves on the venous tracing.

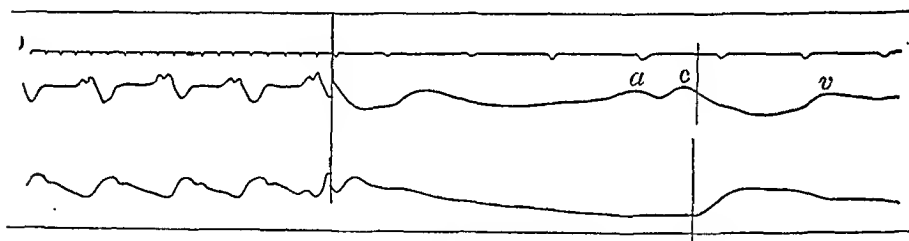


FIG. 2.—Case III. Normal pulse of October 17, 1908.

and somewhat muffled; the second sound weak. The aortic second sound was of about the same intensity as the pulmonic second. On the following day the pulse became regular, and tracings showed a perfectly normal picture (Fig. 2), but on the 12th the pulse again became irregular and the tracings were the same as those taken shortly after his admission to the medical ward. He had several paroxysms during his stay, but on being placed on digitalis these attacks ceased, so that he was discharged on October 17 with a regular heart action and apparently well. Letters from the physician who later attended him, Dr. Backus, of Fayette, Ohio, stated that early in December, following several more paroxysms, the pulse became permanently irregular. On June 4, 1909, he was readmitted to the hospital with a permanently irregular heart of the ventricular type, as shown by venous tracings (Fig. 3). His shortness of breath was much in-

creased, there was some cyanosis, with a very troublesome cough, but no essential change in the outlines of the heart. The apex beat was now of a very heaving character, spreading over the entire precordium. He left the hospital a week later very little improved and the heart action still showing the characteristics of a permanent delirium cordis. He died a few months later.

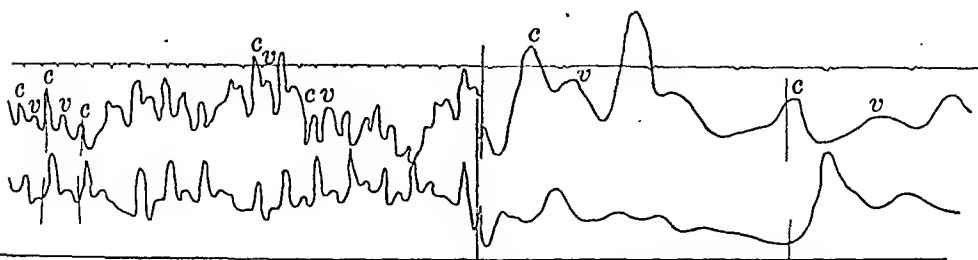


FIG. 3.—Case III. Tracing during the permanent irregularity, June, 1909.

CASE IV.—*Emphysema; myocardial insufficiency, with enlarged heart; only one paroxysm observed, then became permanent.*

Mr. W., aged fifty-nine years, was admitted to the out-patient medical clinic on January 6, 1907, complaining of shortness of breath on exertion, swelling of the lower extremities, and a very severe persistent headache. The family history was negative except for a vague account of cardiac trouble in the parents. His personal history was negative except for occasional swelling of the feet in the evening and periodic headaches, for which he had taken large quantities of acetanilide. For the last seven years these symptoms had progressively increased.

Examination: Thorax short, round, approaching a barrel-chest type. Slight cyanosis of head and extremities. No apparent dyspnoea. Veins of arms and chest full, neck veins not prominent, systolic pulsation not marked. Percussion showed heart boundaries apparently not enlarged. Apex beat poorly seen, felt in the fourth intercostal space inside nipple. At apex, first sound distant, muffled, followed by prolonged rather harsh blowing murmur transmitted outward but not upward. Murmur not heard in axilla or back. Sounds at base very feeble, aortic scarcely audible, radial fairly full and rather compressible, artery moderately thickened. Systolic pressure, 115; diastolic, 75 mm. Hg. Venous tracings taken at this time showed a regular heart with well-marked "a-c-v" rises on the venous pulse.

On the 11th of the same month he returned to the clinic complaining of another attack of intense headache, rapid pulse, and palpitation of the heart. On examination, there was nothing marked except the extreme irregularity of the radial pulse and slightly increased cyanosis. Tracings taken showed a typical delirium cordis, with the ventricular type of venous pulse.

On the 15th he was seen at his home, and apparently had com-

pletely recovered from his attack. The pulse was perfectly regular, both as to rate and intensity, and the subjective symptoms were those present on his first visit to the hospital.

He returned to the clinic on March 1 with a partial return of the symptoms which he had had on January 11, the dyspnœa being a little less, but with marked swelling of the feet. The pulse at this time showed no abnormality.

On December 12, 1909, he was seen again. He complained of dyspnœa on unusual exertion, spells of nervousness, and occasional palpitation, but on the whole he felt better than he had at any time during the past year. More tracings were taken, which showed the positive pulse, with a fairly well-marked irregularity of the radial. He said that his pulse had been irregular ever since he was last seen (March 1, 1907).

CASE V.—Arteriosclerosis; myocardial insufficiency, with enlarged heart; numerous paroxysms observed; later became permanent.

Mr. S., aged sixty-eight years, was admitted to the medical clinic of the University Hospital, April 9, 1909, suffering from weakness, palpitation, and shortness of breath on exertion. His family and past history were negative, except for several slight attacks of inflammatory rheumatism at an early age. The trouble which brought him to the hospital began about two years previously as gradually increasing weakness and inability to undergo any exertion without a consequent period of breathlessness, which sometimes assumed such proportions that the patient became very much alarmed. His weight dropped during the winter over forty pounds, and was gradually going down during the early spring. He found that while in bed the palpitation of the heart was much lessened, and as a consequence he had been more or less in a recumbent position for a month or so. The examination showed an emaciated man with wasted musculature and pale muddy complexion, and in general he presented the picture of one suffering from a severe constitutional disturbance. His apex beat was heaving in character and well localized in the sixth intercostal space just outside the mammary line and about 11 cm. to the left of the median line. The area of cardiac dulness was very difficult to outline accurately, but extended about 1 cm. beyond the right border of the sternum. The upper border was apparently in the third intercostal space, and the left boundary about 12 cm. from the middle of the sternum in the fourth intercostal space. The first sound at the apex was somewhat impure, but without any definite murmur. The pulmonic second was louder than the aortic second, but neither was markedly accentuated. There was marked beaded sclerosis of the radials, and hard, tortuous brachials and temporals. When the patient first came to the hospital his pulse was regular as to rate and intensity of beat, but on the third day after admission it was noticed to be extremely irregular and intermittent. Before the apparatus could be prepared to take

tracings from the radial, this irregularity had disappeared, and when the tracings were finally taken, they showed a perfectly regular action, the rate being about 98 to the minute, with well-marked *a* waves on the venous record. On the 14th the pulse again became slightly intermittent, and while the apparatus was being applied to his wrist the heart became extremely irregular and remained so while two tracings were taken (Fig. 4), and then quite suddenly and

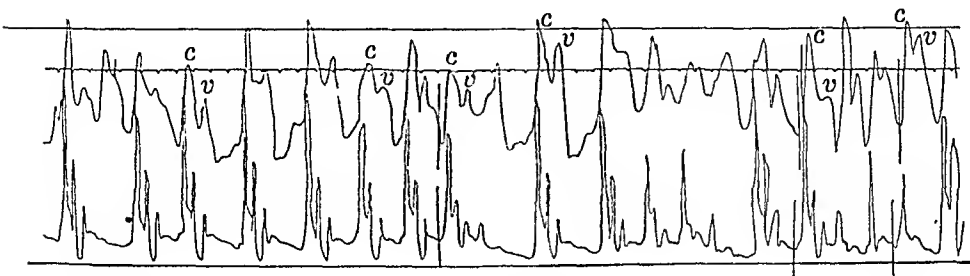


FIG. 4.—Case V. Attack of delirium cordis on April 14. Note that the venous pulse is of the positive type, beginning almost simultaneously with the radial.

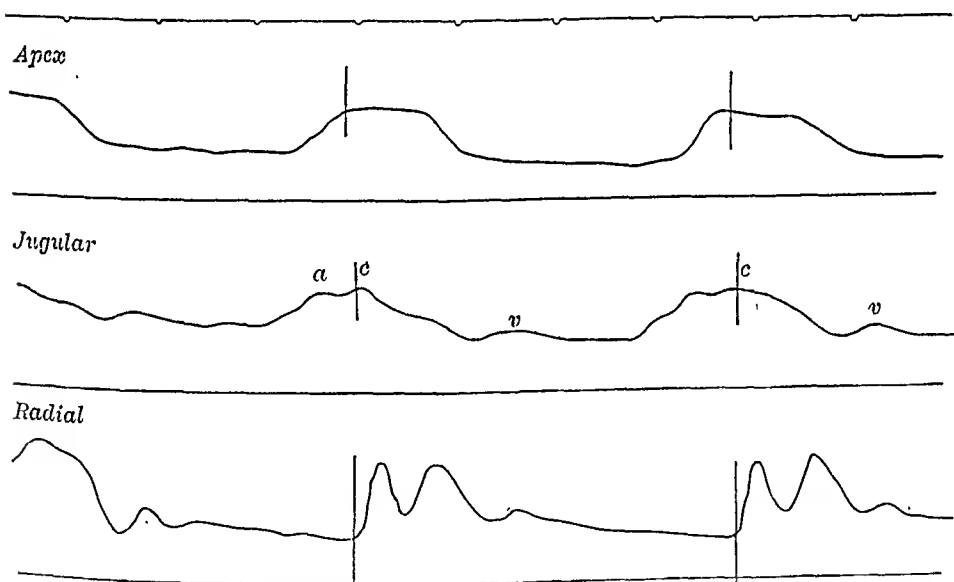


FIG. 5.—Case V. Taken a few minutes after Fig. 4. Note that the pulse is now regular and that the venous pulse begins distinctly earlier than in Fig. 4, owing to the presence of an auricular wave.

without any apparent cause became perfectly regular again (Fig. 5). Several other sets of tracings were taken during the regular and irregular intervals (Fig. 6). In each case when the cardiac action was regular we had a normal inception of the rhythm, the *a* wave slightly preceding the ventricular systole, with the *c* and *v* waves following in order, while the tracings taken during the periods of irregularity showed the ordinary characteristics of the absolutely irregular heart—no *a* wave whatever, and the large *c* and *v*

waves which occur in this condition. During the paroxysms of irregularity he showed pronounced dyspnoea, with some slight cyanosis and all the subjective symptoms of an embarrassed circulation. On closer questioning, he stated that he had had several attacks of a like character previous to his admission. He was discharged on April 16, his heart action being perfectly regular at the time. Dr. Hargrave, of Palo, Michigan, who attended him on his return home, stated in a letter received November 24, 1909, that the arrhythmia has now become permanent, with a change for the better, however, in the subjective symptoms under complete rest and large doses of strychnine sulphate.

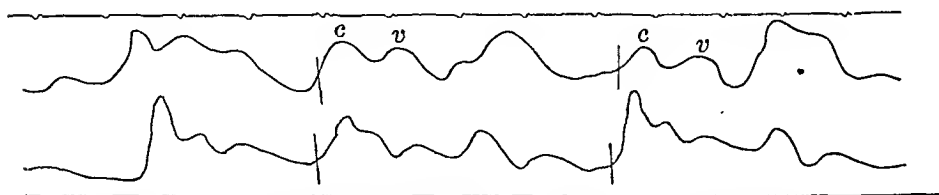


FIG. 6.—Case V. Tracing during the irregularity of April 15. The pulse is very irregular and the auricular waves are absent.

CASE VI.—Several paroxysms of irregularity following operation; heart apparently normal between attacks; up to present has remained regular.

Mrs. H., aged forty-two years, was admitted to the gynecological service of the University Hospital in October 29, 1909, suffering from carcinoma of the uterus. There was nothing in her family or personal history which caused any suspicion of cardiac trouble, but on November 4, two days after operation, her pulse became very irregular and intermittent. This was unaccompanied by any symptoms on the part of the patient, and as it lasted only a few hours, no particular notice was taken of it. She had another period of irregularity on the 6th, which was very transitory, but on the 7th, upon the appearance of the irregularity, tracings were taken which showed a moderate degree of irregularity of the radial pulse, with a marked ventricular venous tracing (Figs. 7 and 8). The heart, when examined on her admission to the hospital, was perfectly normal in every respect; no enlargement and no murmurs. An examination of the heart was made and an orthodiagram taken during this period of irregularity, but no abnormalities other than the arrhythmia could be detected. At no time during any of the paroxysms did she complain of any distress, nor could she remember ever having had any irregularities previous to the present one. Ten days later she was discharged from the service, her pulse in the meantime remaining perfectly regular, the tracings taken showing no change from the normal whatever.

REMARKS. We have, then, six cases of transitory irregularity. Venous tracings were taken in five of these, and they showed the typical absence of *a* waves during the paroxysms and perfectly normal tracings during the periods of regular heart action. Five of these cases subsequently became permanently irregular, and the sixth was observed for too short a period to be certain that it, also, would not become permanently irregular in time. Venous tracings taken after the pulse had become permanently disorderly showed the ordinary characteristics of that condition.

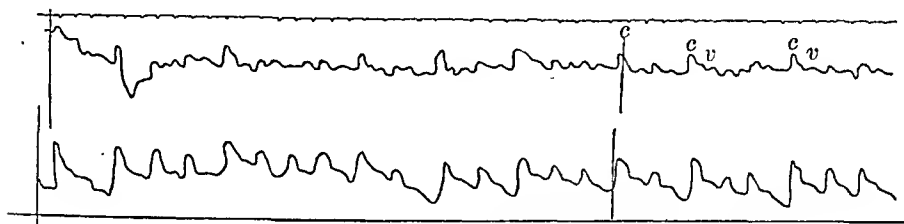


FIG. 7.—Case VI. Paroxysm of delirium cordis on November 7.

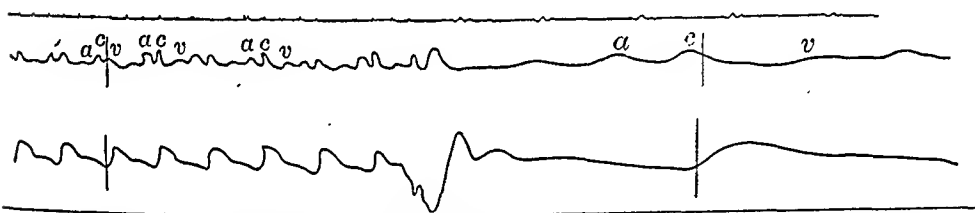


FIG. 8.—Case VI. Regular and normal heart action five hours after the preceding tracing was taken.

These patients were all above forty-two years of age, ranging between that and sixty-eight years. The number of paroxysms and the duration of each varied in each case, the greatest number observed occurring in Case V, most of which, however, were of short duration. The exciting causes of the paroxysms in Case I were several—excitement, exhaustion, and vomiting being the most prominent. Emotional disturbances in Case II would frequently bring on attacks of irregularity, although she, too, like the preceding, would suffer a paroxysm when she became unusually exhausted. The attacks in the remaining cases came on from no apparent cause, some of the paroxysms in Case V occurring while he was resting quietly in bed. Two of the cases developed their first irregularity after operation, neither one of which revealed any abnormal cardiac condition on initial examination. The time which elapsed between the first observed attack of irregularity and the establishment of a permanent delirium cordis could not be ascertained very definitely in each case, but the longest observed time was approximately fifteen months and the shortest three months. Case I, however, believed that she had had such attacks for twenty years.

Physical examination of the heart showed one case of mitral stenosis. Two patients had large hearts with myocardial insufficiency on the first examination, one of these having a systolic murmur presumably due to a relative mitral insufficiency. In the remaining three there were no abnormal signs previous to the first attack or between the paroxysms, but later, when one of these became permanently irregular, the heart was slightly larger. In Case VI the orthodiagraph showed no change in the size of the heart during a paroxysm.

The nature of this irregularity is still a matter of conjecture. In all these cases the attacks developed and ceased suddenly. This, together with the complete change in the character of the venous pulse, leads one to assume that in some way an abnormal inception of the cardiac rhythm had occurred. Two main theories as to the nature of this abnormal rhythm are held at present. These are: (1) The "nodal rhythm" of Mackenzie, and (2) auricular fibrillation (Cushny and Edmunds, Lewis,⁷ Rothberger and Winterberg⁸). According to the first theory, these attacks of transient irregularity are caused by a change in the point at which the cardiac rhythm is initiated, shifting from the remains of the sinus venosus to the persisting portion of the primitive tube farther down, that is, the auriculo-ventricular node. When this occurs, the impulses travel both ways, up and down the His bundle, with a consequent simultaneous contraction of auricles and ventricles. According to the auricular fibrillation theory, the auricles pass into a state of fibrillation. In this condition coördinate auricular contractions cease and the separate portions of the muscle fibrillate, so that as an organ the auricles have ceased to beat and remain practically motionless. In this way an irregular discharge of impulses from auricles to ventricles occurs, and the ventricles beat in a more or less disorderly manner, with no evidence on the venous tracing of any auricular contractions.

CONCLUSIONS. Of six patients in whom transient attacks of delirium cordis were observed, five eventually developed the permanent type of irregularity. Many features of the attacks themselves would suggest a nervous condition, especially the onset under excitement and the complete recovery between attacks with no demonstrable heart changes. The prognosis, however, should be guarded and efforts made to avert the onset of permanent irregularity, which is practically always accompanied by symptoms of cardiac insufficiency.

⁷ Auricular Fibrillation: A Common Clinical Condition, *Brit. Med. Jour.*, November 27, 1909, p. 1528.

⁸ Vorhofflimmern und Ahythmia perpetua, *Wien. klin. Woch.*, 1909, xxii. No. 24.

ERYTHREMIA OR POLYCYTHEMIA WITH ENLARGED SPLEEN AND CHRONIC CYANOSIS.

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A SUFFICIENT number of cases are now on record to identify erythremia as a distinct clinical entity. Of the symptom-trinity of the disease—cyanosis, polycythemia, and enlarged spleen—the first, cyanosis, although naturally the symptom which called the attention of clinicians to the patients in most instances, is by no means a constant element in the disease. Either for this reason, or perhaps also because of the greater convenience of a binomial nomenclature, in the more recent appellations of the disease, such as, erythremia or polycythemia splenomegalica, the cyanosis is not included in the name. In the majority of cases, however, the conditions are extremely favorable to the appearance of the cyanosis or purple staining of the skin. In many cases the cyanosis is purple rather than blue, suggesting an added hyperemia. The cyanotic coloration is usually seen on the face, the hands, and feet, but in exceptional cases it may extend over the whole surface of the body.

The hypertrophy of the spleen, though less striking at first sight than cyanosis, is yet a cardinal element of the syndrome. The degree of enlargement of the spleen is very variable. In the majority of cases it is moderate, the spleen extending one or two inches beyond the costal margin. In some cases, however, it may extend to the umbilicus, or even, as in one of Reckzeh's cases, to the crest of the ilium.

A point of importance is the fact that the splenomegaly may manifest itself for a long time before the appearance of the cyanosis. In one of Saundby and Russell's cases the patient first complained of abdominal pains and headache, and a moderate enlargement of the spleen was detected. It was only seven years later that the patient presented himself with cyanosis of the face and well-marked Hippocratic fingers. This case bears out Weber's opinion that the initial phase of this disease consists of polycythemia with splenomegaly, and without cyanosis.

Polycythemia also plays an essential part in this disease. Until recently any increase in the number of red corpuscles was only known as the result of the loss of fluid from the vascular system, as in serous diarrhoea, cholera, profuse sweating, etc., or as a consequence of residence in high altitude. The first observers of this disease were, therefore, not a little astonished at the enormous increase of the red blood corpuscles which they met with in the victims of this disease.

The blood has a very dark purple, almost black, color, and flows sluggishly from a prick or slight cut. Osler notes particularly the length of time it takes to spread over a coverglass. This viscosity of the blood may be from three to four times greater than normal, and in all probability it is due to the marked increase in the number of red corpuscles. The coagulation time also is markedly shortened, being in some cases as little as two minutes.

But the great and outstanding feature is the tremendous polycythemia. The red cells range from 8,000,000 to 12,000,000 per cubic millimeter, and in one of Reckzeh's cases it reached a much higher figure. There is also a markedly high percentage of polymorphonuclear cells, and some observers take this to mean unusual activity in the bone marrow. The hemoglobin is usually from 125 to 150 per cent. and in one of Rosengart's cases, reached the high figure of 200 per cent. The specific gravity of the blood varies from 1054 to 1081, and in one of Preiss' cases reached the figure 1094.

Early in the disease the patient complains of headaches, has occasional attacks of dizziness and possibly vertigo. Later there is noticed distinct mental torpor and impaired memory, and the patient may be confused or incoherent. Great weakness and prostration may supervene, and the patient's speech may become indistinct or slow and difficult in the later stages.

Besides the headache and vertigo in the early stages, there are usually abdominal pains with nausea and vomiting, accompanied by constipation or sometimes diarrhoea. The abdominal pain is usually in the left hypochondrial region. These pains are due to the hypertrophy of the spleen, and may remain the only symptom for years. The urine usually contains albumin.

The disease is of very long duration, lasting from four to ten years and upward, with periods of remission. It usually affects people of middle age. Men and women appear to be equally subject to it. Of 7 cases which Türck described, 5 were of Jewish origin, and Türck is inclined to believe that this is no mere coincidence, but that it may point to the Hebrew race being more subject to the malady than other races.

A number of therapeutic agents have been tried, notably quinine in Begg and Bullmore's case, as well as Fowler's solution in Türck's case; on both occasions with apparently good results. From the fact that spontaneous hemorrhages in the course of the disease often give relief, Rosengart suggests bleeding frequently repeated. In one of his patients this measure produced temporary relief. To produce any lasting therapeutic effect, however, some hold that one ought to resort to the profuse blood-lettings of the old barber-surgeons and abstract 500 to 600 cubic centimeters or even more at one sitting. In Begg and Bullmore's case inunction of biniodide of mercury ointment over the spleen was resorted to, and

the part exposed to artificial heat, while, as already stated, quinine was given in increasing doses up to 45 grains a day, with most encouraging results. Considering the fact that the disease usually proceeds to a fatal termination, Vazquez and Laubry recommend splenectomy.

The postmortem findings have revealed several interesting conditions. There is a general extreme distention of all the minute vessels with blood. The minute mesenteric venules remind one of the appearance seen in an anatomical preparation in which the vessels have been forcibly injected with some dark blue mass. In Westenhoeffer's case the quantity of blood which flowed from the vessels at the root of the heart when these were cut was said to be extraordinary. All the medium-sized arteries are more or less sclerosed, while the left ventricle of the heart is usually hypertrophied. The marrow of the long bones is uniformly dark red and has a striking resemblance to the marrow of children, while under the microscope it exhibits signs of great activity. The spleen, though enlarged, is of practically normal structure, the trabeculae and septa being merely thickened, while the spleen pulp is increased.

Until recent years practically no light has been thrown upon the etiology of this disease. When Vazquez, in 1892, published his first case of cyanosis accompanied by polycythemia he attributed the cyanosis to a congenital heart lesion, as was perfectly natural at that time. This, however, was not confirmed at the autopsy which occurred four years later; a considerable hypertrophy of the spleen and liver was revealed. Rendu and Widal considered that the morbid processes were the result of tuberculosis of the spleen. But although such tuberculosis has been made out in a number of cases, it is by no means universal.

Many pathologists now believe this to be a disease of the bone-marrow which takes upon itself extraordinary powers of producing red cells. But the exact cause of this renewed activity remains obscure. We know that this increased functional activity may be physiological as well as pathological. After severe hemorrhage the marrow has been found with greatly increased numbers of nucleated reds, and evidence of an attempt to re-supply the blood with red cells. But what is the cause of the renewed activity in this disease is at present problematical.

It may be that there is a partial abatement of the function of the spleen which stimulates the bone marrow to an increased production of red blood cells. There is still much to be learned about the spleen. The uncertainty as to the exact uses and functions of this organ make it difficult to estimate the influence of disease upon it. When the blood and spleen are both abnormal, as in erythremia, the question arises, "Is the blood disease the cause of the large spleen, or is the large spleen the cause of the diseased blood?"

If the spleen is a blood-forming or a blood-destroying organ, it might be conceivably hypertrophied in consequence of disease in other blood-forming organs such as the bone marrow. The main characteristics of the spleen in this disease point to chronic irritation which has given rise to thickening of the trabeculae and septa and increase of the spleen pulp. This irritation may be merely mechanical, such as might be caused by the excessive quantity of leukocytes coming from the bone marrow.

In this theory, which supposes a process analogous to tumor formation, Weber thus summarizes the sequence of events: (1) There is increased erythroblastic activity in the bone marrow; (2) increased viscosity of the blood results from this polycythemia; (3) there is then dilation of the small bloodvessels so as to lessen the resistance to the abnormally viscous blood; (4) the arterial hypertonia is the result of the great strain thrown upon the circulatory mechanism; and (5) the cyanosis, when it occurs, is probably due to inadequacy of the series of compensatory changes which precede it.

Another theory attributes the disease to some unknown toxin. This theory, which has the weighty support of Metchnikoff, assumes that some toxin of a hemolytic nature is manufactured in the enlarged spleen and is absorbed into the circulating blood in minute quantities, not sufficient to cause much hemolysis, but enough to excite reaction in the blood-forming tissues. Belenovsky, by injecting minute doses of hemolytic serum into the blood of anemic persons, has succeeded in raising not only the number of corpuscles, but also the amount of hemoglobin, a very striking result which adds some measure of support to this theory.

Türk's theory is similar to that just described. That investigator believes that a primary disease of the erythroblastic myeloid tissue causes, on the one hand, a functional increase of activity (polycythemia and cyanosis), and on the other, tumor of the spleen and eventually also of the liver. Some poisons excite the leukoblastic function of the myeloid tissue positively, that is, cause a hyperplasia (leukocytosis, leukemia), while others diminish that function (typhoid-leukopenia), and so it is conceivable that the erythroblastic function of the myeloid tissue might be excited in the positive (erythremia) or negative (pernicious anemia) direction.

Reckzeh believes that venous stagnation plays an important part in the causation of the symptom complex. He describes experiments in animals which show that obstruction to the circulation may produce the symptoms characteristic of erythremia. In one of his own clinical cases nature herself performed such an experiment. A slow-growing tumor of the thymus and lungs in a young man caused a gradual compression of the superior vena cava. The result was an increasing cyanosis of the upper half of the body with polycythemia and tumor of the spleen. In another of Reckzeh's clinical cases a cardiac disease caused disturbance of

the circulation with resulting cyanosis and polycythemia. Reckzeh suggests that the swelling of the spleen may be due to the increased destruction of the numerous erythrocytes. Perhaps a diminution of the tone of the veins plays some part in the production of the symptoms.

Osler has pointed out that polycythemia occurs in those cases in which the adequate aëration of the blood is interfered with, in such cases as congenital or acquired disease of the heart, in poisoning by carbon dioxide, phosphorus, and other substances, and by residence in places of high altitude. The suggestion has been made that the polycythemia of erythremia is the result of an adaptation of the blood-forming tissues to the diminished pressure of oxygen in the blood. Certain observations have been made which go far toward showing that in this disease the hemoglobin takes up too little oxygen. For example, Koranyi found that the red blood corpuscles were rapidly lessened by the inhalation of oxygen, and Bence found that the inhalation of oxygen not only diminished the number of red blood corpuscles to the extent of a million and a half per cubic millimeter, but also caused a diminution in the viscosity of the blood.

In the polycythemia of high altitudes, heart disease, and certain forms of poisoning, it is known that oxygen inhalation has exactly the same effect as Koranyi and Bence noted in this disease. Mohr has also found that although the hemoglobin in these cases is enormously increased, yet the blood is capable of taking up no more oxygen than normal blood. From considerations such as these the view has been put forward that erythremia may be the result of a primary diminution in the absorption of oxygen, with a secondary hyperplastic change in the bone marrow and a compensatory increased formation of red blood corpuscles.

Such are the various theories which at one time or another have been put forward by different investigators to elucidate the pathology of this interesting disease. It must not be supposed that they are mutually incompatible; on the contrary, they may be made to fit in with and supplement one another. The new clinical entity is apparently the result of a long-connected chain of pathological events, and as the different observers have concentrated their attention upon one or other link of the chain, there have originated the different views and theories which we have enumerated.

The sequence of events may thus be summarized:

1. Let us assume, to begin with, that there is, as a *causa causans*, some deterioration in the quality of the hemoglobin. This would result in—

2. A diminished absorption of oxygen. The necessity for a compensatory increase in the amount of hemoglobin and in the number of red blood corpuscles would bring about—

3. An increased erythroblastic activity in the bone marrow. The resulting polycythemia would give rise to—

4. The increased viscosity of the blood. To lessen the resistance due to this there would be—

5. A dilation of the small bloodvessels and possibly also a venous stasis. The great strain thrown upon the circulatory mechanism would bring about—

6. Sclerosis of the arteries and hypertrophy of the left ventricle of the heart. The increase in the number of red blood corpuscles might be conceived as causing a chronic irritation of the spleen, acting either mechanically or by the agency of a toxin produced as a by-product of the increased activity in the bone marrow. The result of this would be—

7. Enlargement of the spleen. When the compensatory changes fail or become inadequate, the result is—

8. Cyanosis.

CASE I.—Mrs. S., aged sixty-one years, a housewife, German by birth.

Family History. Her father died at seventy-five, of old age. Her mother died at sixty, of heart disease. One brother died of tuberculosis at fifty. Two sisters died at about the age of sixty, cause unknown.

Personal History. She has had the ordinary diseases of childhood. Menstruation began at the age of fourteen and ceased at the age of forty-one. She was never pregnant, nor has she had any symptom of uterine or ovarian disease so far as she remembers. After the menopause she developed a cystic goitre, which continued to grow up to the time of her death, March, 1909. About six years ago she began to be troubled with headache, dizziness, and general weakness, which was most marked in climbing stairs. Six or eight months later she noticed two swellings, one on each side of her abdomen, beginning at the costal arch and extending downward, until at the present time they have filled most of the abdomen. Since the beginning of this trouble she has noticed spots and blotches all over her body, which are red when in a warm room and purple when exposed to cold. They are most numerous on her face and limbs. Those of the limbs are a much deeper purple than those of the face. Her mucous membranes are also of a purplish-blue color. For the last year she has suffered from diarrhoea of a mucous type, consisting of 8 to 10 stools per day. The patient has frequently noticed that when she accidentally cuts a finger the blood is of a dark-brown color and coagulates almost immediately. Her digestion has been very poor since the beginning of this trouble, although she has never vomited. She perspires freely and frequently, especially after slight exertion.

Physical Examination. Her height is about 5 feet 5 inches, and her weight is about 115 pounds. Her gait is somewhat uncertain

on account of weakness. Her face has a purplish hue, especially marked on the nose and cheeks. The arms, legs, and abdomen are covered with the same colored blotches, from the size of a silver dollar to the size of the palm of the hand. Her superficial veins are much distended and of a black color. The muscles of the entire body are atrophic, thin, and flabby. Her tongue is clean but cyanotic. The skin is thin, shrivelled, and inelastic. Her nails are typically Hippocratic. On her neck there is a large bilateral cystic goitre the widest circumference of which is 24 inches. The neck above the goitre measures 14 inches. In spite of the size of the neck-tumor, it seems to interfere very little, if at all, with her respiration, which is from 20 to 22 per minute. The lungs are normal and the heart shows nothing abnormal on auscultation or percussion except a slight accentuation of the second sound. The pulse averages between 85 and 95 per minute, being hard, and compressible with difficulty. Her temperature at all times is normal or slightly sub-normal. Examination of the abdomen reveals an enormously enlarged spleen and liver. The splenic notch is very distinct at a level with the umbilicus. The lower end of the spleen extends to 3 inches below the umbilicus; its surface is smooth, hard, and painless to pressure. The liver also extends down to a level with the umbilicus. It is also hard, smooth, and painless to pressure. Percussion along the shin bones elicits some tenderness. There is no dropsical accumulation in the limbs or abdomen. The reflexes are normal and the pupils respond promptly to light. Ophthalmoscopic examination shows nothing abnormal except an enlargement and tortuosity of the retinal veins. There is no glandular enlargement in any part of the body.

Examination of the urine is as follows: 25 to 35 ounces in twenty-four hours; yellowish-red in color; acid in reaction; 1010 specific gravity; a trace of albumin; no sugar; no casts; urea, 3 per cent.; diazo reaction, absent.

Examination of the blood during the two months before death showed, on an average, as follows: Hemoglobin, 180 per cent.; red cells, 15,500,000; white cells, 14,000; coagulation time, one minute. The red cells were normal in size and shape with an occasional normoblast. The differential count of the leukocytes was as follows: Neutrophilic leukocytes, 53 per cent.; eosinophilic leukocytes, 4 per cent.; basophilic leukocytes, 2.5 per cent.; mononuclear leukocytes, 3 per cent.; small lymphocytes, 23 per cent.; large lymphocytes, 14.5 per cent. The blood was very dark and viscid, and spread on the slide with great difficulty.

CASE II.—Mrs. H., aged forty-three years, a housewife, a Russian Jew.

Family History. Her father died of old age at the age of seventy-seven years. Her mother died at the age of fifty-one years, cause unknown; she was confined to bed each winter for twenty years on

account of coughing and spitting of blood. She has one sister living at the age of seventy-five years who is in perfect health. One sister died at the age of forty-eight years from kidney disease. One brother died at the age of sixty years, of unknown cause.

Personal History. She escaped all of the ordinary infectious diseases of childhood except measles, which she had at the age of six. Menstruation first started at the age of fourteen and was normal in every respect. She married at the age of twenty, and gave birth to five living children and miscarried four times. She was in perfect health until about three years after her marriage, when she began to complain of dizziness and nausea, which was followed by headaches and severe pain in her fingers and toes, from which she could obtain no relief, day or night. About six years ago she had a miscarriage, which was followed by a severe hemorrhage and prompt relief in her fingers, no doubt due to the loss of blood. She came under my observation in 1906 complaining of weakness, dizziness, and inability to bend down on account of some lump in the left side of her abdomen, which on examination was found to be the spleen. This enlargement was first noticed by her after the birth of her last child, which at that time was nine months old. She slept well but could not lie on her left side. Intense thirst has been continuously present since the disease began. During the two and a half years she has been under my observation all the symptoms have become more severe and the general weakness more pronounced.

Physical Examination. The patient is about 5 feet 3 inches tall and weighs about 105 pounds at the present time. Her face has a purple hue which is most marked on the lips, nose, and cheeks. Her conjunctivæ, tongue, and mucous membrane of mouth are also very purple. Patches of the same color are scattered over the body, especially on the arms and legs. There is no glandular hyperplasia in any part of her body. The skin is flabby and her muscles have become atrophic. When she first came under my observation, in November, 1906, she was still quite stout and weighed 155 pounds. At that time she was nursing a nine-months-old baby. Examination of the chest discloses nothing abnormal in her lungs. Her heart is normal, although weak, and has lately developed a slight accentuation of the second sound. Her pulse varies from 85 to 95 per minute. The arteries are somewhat hard, but not so marked as in the other case. Examination of the abdomen discloses an immensely enlarged spleen, the notch of which is distinct at the level of the umbilicus. The hypertrophied organ extends down to the level of the crest of the ilium. During the time that she has been under my care its size has varied very little. The liver, which was at first normal in size, has become markedly enlarged. Both the spleen and liver are hard and smooth and not painful to pressure. Examination of her limbs reveals some varicose veins, especially on the left side, but there is no œdema. Her finger nails are markedly Hippocratic. Her

reflexes are normal and her pupils are equal and respond promptly to light. Ophthalmoscopic examination shows some tortuosity and enlargement of the veins. Examination of the genital organs shows the uterus prolapsed to the vaginal opening. It contains a stellate laceration of the cervix. The perineum also has an old laceration. Menstruation was regular up to one year ago, when it ceased abruptly.

Examination of the blood at various times during the last two years has shown a gradual rise in the amount of hemoglobin and red blood corpuscles. The last estimation was as follows: Hemoglobin, 170 per cent.; red cells, 15,000,000; white cells, 12,500; and coagulation time, one minute. A differential count of the leukocytes was as follows: Neutrophilic leukocytes, 73 per cent.; eosinophilic leukocytes, 2 per cent.; basophilic leukocytes, 1.8 per cent.; mononuclear leukocytes, 3.2 per cent.; small lymphocytes, 16 per cent.; large lymphocytes, 4 per cent. A few normoblasts and megaloblasts were occasionally found. The color of the blood was dark red and it coagulated so rapidly that blood counts were made with difficulty.

Examination of the urine gave the following results: Quantity, 40 to 55 ounces in the twenty-four hours; amber in color; acid in reaction; 1020 specific gravity; no albumin; no sugar; no casts; urea, 2.5 per cent.; uric acid, greatly increased; and the diazo reaction always present.

The treatment in both cases has had very little influence, if any, on the course of the disease. Arsenic, quinine, and the x-rays were faithfully tried, but without any result. Inhalations of oxygen gave temporary relief for at least twenty-four hours at a time. Removal of 250 c.c. of blood in Case I gave only transient relief, lasting not more than forty-eight hours.

TUBERCULOSIS AND MENSTRUATION.

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TUBERCULOSIS! Menstruation!—Two vast chapters in medicine, on each of which so much work has been done and so much has been written that one is hardly justified to read a paper unless one has something really new or important to communicate. When we consider, however, the relation of these subjects, tuberculosis and menstruation, to each other, we are confronted with a dearth of

information truly remarkable, enough to serve as an apology even for so incomplete a paper as this one. A glance at some of our standard works will show that the subject is either entirely overlooked or receives but a passing notice. Cornet's¹ work, probably our standard reference book on tuberculosis, devotes but half a page to the subject; in Osler's *Modern Medicine*² we find but one short paragraph; the article in Allbutt's *System*³ dismisses it with a few lines; and in Bonney's⁴ popular American work on consumption the word menstruation is not to be found in the index. And yet, the menstrual function, powerfully as it affects the entire constitution of even a healthy woman, does certainly exert a marked influence on the course of various diseases, and on none more than on pulmonary tuberculosis. It is with the hope of stimulating further interest and research that I make this humble report.

At the outset I wish to state that we are concerned here not with tuberculosis in general, but chiefly with tuberculosis of the lungs, or phthisis. Nor are we concerned here with tuberculosis of the female generative organs, however interesting such an affection might be in connection with our subject; indeed, as much as possible I tried to eliminate all such cases in compiling the statistics, in order to obtain more definite conclusions. For convenience of discussion, I shall consider the subject from two points of view: (1) The influence of pulmonary tuberculosis on the menstrual function; and (2) the influence of the menstrual function on the course of pulmonary tuberculosis.

1. THE INFLUENCE OF TUBERCULOSIS ON MENSTRUATION. I suppose everyone, medical and layman, has a notion that tuberculosis *does* exert an influence and that a deleterious one on the menstrual function of woman; and probably the prevailing idea is that in consumption, as in a great many other infections, there is a suppression of the menses. That is true, but only to a limited extent. As a matter of fact, studying the subject a little more carefully, we shall be surprised to find, besides amenorrhœa, a remarkably large number of patients menstruating without any noticeable change almost to the end, and still more interesting, quite an appreciable number of patients with menorrhagia or an increased, profuse flow of the menses.

I have reviewed the histories of practically all the patients admitted to the Phipps Dispensary of the Johns Hopkins Hospital from the time of its opening, on March 1, 1905, up to a very recent date, about 5500 histories in all, and out of these I have selected and analyzed the histories of nearly all the female patients between the ages of twelve years and forty-five years, which is, roughly, the period of sexual life of woman. I have in all thus studied about

¹ Die Lungentuberkulose, 1907.

³ Allbutt's System of Medicine.

² Modern Medicine.

⁴ Pulmonary Tuberculosis.

1600 cases. These I have classified in various ways, and the following tables show the results.

Classifying the patients according to the *type* of menstruation, I obtained the figures in Table I.

TABLE I.

	Per cent.
(1) Regular menstruation, with no change noted	51.6
(2) Amenorrhœa	27.3
(3) Irregular menstruation	8.3
(4) Menorrhagia	4.6
(5) Pregnant or lactating	4.4
(6) In menopause, artificial or otherwise	3.8
	<hr/> 100.0

Here we see that 51.6 per cent., or over one-half of the patients, at the time of admission, gave a history of no change in menstruation at all; 27.3 per cent., or over one-fourth, gave a history of amenorrhœa, or more or less scanty flow or suppression; and 4.6 per cent. complained of a more profuse flow than ordinarily, without any history of uterine or adnexal disease. Under the third class I put all those patients giving a history of irregular flow. Some of these later become menorrhagic, others amenorrhœic. In Class 5 I placed all those patients in whom suppression of menses could be accounted for on grounds other than tuberculosis; and in Class 6, cases with artificial menopause through operation, and other cases of seemingly early menopause.

Now, turning to Class 1, or patients with regular menstruation, in whom no change in the menstrual type could be noted, I was struck, above all, by one remarkable fact, and that is, that change or no change in menstruation depends on one important factor—the age of the patient. I may say, that, whatever the stage or the duration of the disease may be, it is as rare to find the menstruation suppressed in patients of thirty-five years or over as it is to find it present in patients below twenty years. I have been struck by this fact again and again upon looking over our patients' histories, so that we may state it almost as a rule that in patients above thirty-five years, or over, even at an advanced stage of consumption, we shall find a history of regular menstruation.

Amenorrhœa. When we study the cases with amenorrhœa, we find again the age of the patient playing probably the most important role. I have classified our amenorrhœic patients as follows: First, according to the age of the patient:

TABLE II.

	Per cent.
Under twenty years	32.5
Twenty to thirty years	39.0
Thirty to forty years	23.9
Above forty years	4.6
	<hr/> 100.0

Second, according to the stage of the disease, using Turban's classification:

TABLE III.

	Per Cent.
Tuberculosis of the first degree	45.8
Tuberculosis of the second degree	14.0
Tuberculosis of the third degree	23.7
Patients reported dead at the time of compilation of these figures	16.5
	<hr/> 100.0

Third, according to the duration of the disease at the time of admission to the dispensary:

TABLE IV.

	Per Cent.
Less than six months	41.9
Six months to nine months	12.9
Nine months to twelve months	2.8
One year to two years	13.3
Two years to three years	6.7
Three years to four years	7.8
Four years to five years	2.6
Over five years	3.3
Unknown	8.2
	<hr/> 100.0

On examining these tables, we may note three important points: (1) 32.5 per cent. of the patients were under twenty years, and 39.0 per cent. between twenty and thirty years of age, making a total of 71.5 per cent., or nearly three-quarters of all the patients with amenorrhœa below thirty years of age. (2) 45.8 per cent. of the amenorrhœic patients, or nearly one-half of them, were in the first stage of the disease. (3) 41.9 per cent. of the cases were ill for not more than six months. Taking these three data together, it will be seen that amenorrhœa is, therefore, a sign of considerable diagnostic importance. I have repeatedly been led to suspect tuberculosis in young patients by this sign alone.

To cite an illustration: A girl, aged seventeen years, was transferred from the Medical Department of the Hebrew Hospital to me, at the gynecological clinic, with a diagnosis of amenorrhœa. The physical examination of the chest was reported negative. The patient gave me a history of regular menstruation, until a few months previously, when the menses began to be scantier and rarer. On further questioning, I obtained a history of exposure to tuberculous infection. This made me suspicious. Making a rather careful study of the case, in regard to temperature, etc., and with the help of the eye and skin tests, I made a diagnosis of pulmonary tuberculosis. Physical signs soon developed, and the patient is now an advanced consumptive.¹

This is only one example out of many. Probably a great many of the cases diagnosticated in our dispensaries as simple anemias or chloroses, with menstrual disturbances, are of tuberculous origin. The trouble is, we do not think of it. Yet such a history of amenorrhœa, whether in the form of a scantier flow, or of a flow at rarer intervals, is always to be regarded as suspicious, and may be a valuable early diagnostic sign of tuberculosis. True enough, in most cases other suggestive signs may also be found at times, and the tuberculin tests would clear up our doubts. Nevertheless, the menstrual disturbance is a warning sign to be on the lookout, and unless one is on the lookout, even a tuberculosis expert is liable to overlook a case.

I have not attempted to classify the amenorrhœas into various degrees. Amenorrhœa is but a relative term. It may manifest itself in a decrease in quantity, or a scantier flow; or in a decrease in duration of the flow, or in a flow at rarer intervals. In severer cases, this "relative" amenorrhœa may pass into what we may term "absolute" amenorrhœa, or complete suppression of the menses. Such a suppression, coming gradually after a relative amenorrhœa, usually indicates a downward course of the disease, and is a grave prognostic sign. Occurring at the beginning of the disease, however, and especially in young girls, it is not such a grave prognostic sign, but is more of a diagnostic value. Indeed, in tuberculous girls, the menses may be very much delayed in appearance at puberty, and may not appear at all. An interesting fact to be noted, further, is that in advanced consumptives the menstrual flow may cease, and yet all the other symptoms of menstruation, or the "molimina menstrualia," may persist. The patients continue to ovulate, though no longer flowing, and such periodic "ovarian orgasms," as Daremberg calls them, may work great havoc. Of this interesting phenomenon I shall have to say more later.

Why the menstruation should be more liable to change in youth than at a later age in the course of tuberculosis is to be explained by the general hypersensibility of the female organism at the time of puberty. That is, the period of heightened nervous irritability, the period of "Sturm und Drang," both spiritual and physical, when the organism responds more quickly and with greater energy to every new stimulus. Youth, in the language of the Bible, is *N'urim*, which, literally translated, means "vacillation" or "changeability."

Menorrhagia is a most interesting and early sign of tuberculosis, which has hitherto been but little noted. As a rare accompaniment of pulmonary tuberculosis, menorrhagia has been mentioned occasionally by a number of observers. As far back as 1887 Handforth⁵ speaks of menorrhagia as an early sign of tuberculosis, and adds, that children of tuberculous taint are liable to begin

⁵ Brit. Med. Jour., 1887, p. 153.

menstruating early and profusely. Cornet, Osler, and other clinicians admit menorrhagia as an occasional occurrence in tuberculosis; also various gynecologists, such as Winter⁶ and R. Schäffer⁷ include phthisis as an occasional etiological factor in menorrhagia; but none of these observers seem to have laid much stress on the phenomenon and the frequency of menorrhagia in tuberculosis seems to have been greatly underestimated. From Table I we see that cases of menorrhagia form a considerable number, 4.6 per cent., and I think this figure is probably too low; for, since we have been going more carefully into the menstrual histories of our patients, we have come to note menorrhagias more frequently. Menorrhagia, when it does occur, is an early symptom, preceding amenorrhœa, and unless carefully inquired for, may be easily overlooked. For this same reason it is a valuable diagnostic sign. The course of events is usually something like this: A patient's menses being regular and normal, begin without apparent cause to grow more profuse and of longer duration. This continues for a few months, and is followed by a gradual development of amenorrhœa, which may eventually end in complete suppression of the menses. To give one or two illustrations:

Phipps' Case, No. 5217. Mary C., black, aged twenty-five years; married. Admitted January, 1910, complaining of pain in the right side. Present illness dates back to September, 1908. Began with pain in the right side, chills, and fever; then cough, loss of weight and anorexia.

Physical examination revealed advanced involvement of the right lung, with slight infiltration of the left.

Menstrual History. Menarche at sixteen years; periods always regular, every four weeks, lasting four to five days. About two years ago, at the beginning of the present illness, a more profuse and prolonged flow, lasting five to six days. This continued for several months, when the menorrhagia was followed by scantier menses, coming on at longer intervals, and lasting only two days. Since November, 1909, there is complete suppression of the menses.

Phipps' Case, No. 5412. Alice R., white, aged thirty-seven years; married. Comes complaining of bronchitis, loss of voice, and progressive weakness.

Physical Examination. Infiltration of the right upper lobe and laryngeal tuberculosis.

Menstrual History. Menarche at nineteen years; periods were regular, every month, but scanty; duration two days, accompanied by skin eruptions and nose bleeding. Married at twenty years; one child when aged twenty-three years. Periods since then regular, of four to five days duration. Since last year or two, menses became

⁶ Gynäkologische Diagnostik, 1907.

⁷ Veit's Handbuch der Gynäkologie, 1908, iii, 1. (Contains bibliography.)

more profuse, lasting a week or longer; menorrhagia. Was examined by a doctor and no pelvic disease found. For the last few months, beginning amenorrhœa; periods are becoming scantier, the last period being only two days in duration.

Phipps' Case, No. 5573. Elizabeth S., aged twenty-three years, single. Was referred from the medical department as suspicious of tuberculosis. Complains of pain in the chest and back, no cough or expectoration.

Menstrual history: Menarche at fifteen years. Periods always regular, every four weeks, lasting about three days, no dysmenorrhœa, no leucorrhœa. Since last four months periods come more frequently, every three weeks, and last fully three days; in other words, the patient has a menorrhagia. I expected to find tuberculosis. On physical examination a definite tuberculous focus could be demonstrated. The diagnosis was confirmed by a positive eye and skin tuberculin test; and tubercle bacilli were found in the sputum. This patient has not yet passed into the amenorrhœic stage.

What the cause of these menorrhagias may be is a puzzling problem. Two explanations have been offered. Some regard these menorrhagias as belonging to the same class with those of chlorosis and extreme anemia; in other words, as due to a hydremic condition of the blood. The anemias of tuberculosis, however, are but seldom of a severe kind, and are more apparent than real, so that this explanation is not altogether satisfying.⁸ Another and more ingenious explanation is that offered by the German observer Thorn.⁹ Thorn made an extensive and very careful anatomical and pathological study of the uterus in tuberculous patients and found almost uniformly an atrophy of that organ with degenerative changes in the bloodvessels much like those found in the senile uterus at the time of the menopause. The menorrhagias of tuberculosis Thorn regards as being of the same origin as those which occur at menopause, that is, as due to degenerative changes in the vessel walls.

We see, therefore, that quite interesting and diagnostically and prognostically important changes in the type of menstruation may occur in the course of tuberculosis. Briefly to review the facts noted: (1) The menses may remain regular, especially after the thirtieth year of life. (2) The menses may be delayed in appearance, or not appear at all, in young and delicate girls. (3) The menses may be regular, and then gradually be succeeded by amenorrhœa, and eventually by complete suppression. (4) The regular menses may be first followed by a period of menorrhagias, and then succeeded by amenorrhœa, passing finally to complete suppression of menstruation.

Leucorrhœa is such a common symptom in all run-down conditions, not to speak of pelvic diseases, that I did not give it much

⁸ Emerson, Clinical Diagnosis. Chapter on the Blood.

⁹ Beiträge zur Atrophia Uteri, Zeitschr. f. Geb. u. Gyn., xvi, 67.

attention in studying our histories. Some writers, as Gallard¹⁰ and others, speak of the so-called "regles blanches" but these really come under the heading of amenorrhœas. Only occasionally in very young patients, who have never menstruated, do we find a periodic leucorrhœa, as in one of our cases:

Phipps' Case, No. 5400. Lillian Hy., aged thirteen years. Advanced case with vomica in the left lower lobe. Patient never menstruated, but has a periodic pinkish discharge from the vagina.

Dysmenorrhœa. In 1908, two Hungarians, Eisenstein and Hallos,¹¹ reported a number of cases of dysmenorrhœa, which they regarded as of purely tuberculous origin; that is, as a toxic effect of tuberculous toxins in the body of the patient. This dysmenorrhœa was markedly relieved and in many cases entirely cured by tuberculin injections in therapeutic doses. Fifty-three tuberculous patients with dysmenorrhœa not explainable on other grounds were thus treated, and of these, forty received marked and lasting relief, five were but slightly relieved, and eight patients were not relieved at all. Anxious to learn whether such cases might be found among our patients, I questioned a number of our tuberculin class patients, and found at least five patients who extolled the marked relief from dysmenorrhœa which they experienced under tuberculin treatment. We may, therefore, consider some dysmenorrhœas to be of a purely tuberculous origin. Recently, E. Gräfenberg¹² reported similar observations.

The effect of treatment in general, whether it be by tuberculin injections, or by open air treatment and in sanatoriums, tends as might be expected, to bring about a return of the menstruation to its normal type; and such a return coming on after an amenorrhœa, or still more after a suppression, is always a very favorable sign. In some cases, however, climatic treatment, especially in high altitudes, is liable to induce excessive congestion of internal organs with subsequent hemorrhages and occasionally menorrhagias, as noted by L. Joubert¹³ and others, and as is well illustrated by one of our cases:

Phipps' Case, No. 4893. Mrs. Margaret F., widow; white. Admitted September 8, 1909, complaining of "tuberculosis." There is a marked familial history of tuberculosis in the husband's family.

Present illness began three years ago with a hemorrhage from the lungs, followed by cough, expectoration, loss of weight, and general asthenia.

Physical examination revealed an involvement of the entire left lung and the right upper lobe.

Menstrual History: Previous to present illness, periods regular, every month, lasting six days. Since present illness, menses more

¹⁰ Ref. Zentralbl. f. Gyn., 1885, p. 561.

¹² Münch. med. Woch., 1910, No. 10.

¹¹ Zentralbl. f. Gyn., 1908, No. 44.

¹³ Lyon médicale, 1907, No. 25.

profuse, menorrhagia. Patient went to Ashville for a cure. While there she had regular periodie hemorrhages from the womb, or as she describes them "flooding" every month so severe that the physician in charge advised her to go back to sea-level.

This patient had also marked cough and hemoptysis at her periods, but of this I shall treat later.

The following case will illustrate well the beneficial effect of tuberculin treatment on the type of menstruation in general and on dysmenorrhœa in particular:

Phipps' History, No. 4402. Amelia S., aged thirty-four years; white, married. Admitted May 21, 1909, complaining of cough.

Present illness dates to four years back. Began with slight cough and expectoration. This was followed by progressive development of tuberculous symptoms.

Physical examination shows tuberculous infiltration of the right upper lobe, and slight involvement of the middle lobe.

Menstrual History: Previous to present illness, periods were regular, every month, of three to four days' duration. Since present illness menses regularly every twenty-eight days, but scanty and pale. Since three years, total suppression of menstrual flow, but menses continued, patient having severe cramps in pelvis and lower abdomen at the time of expected menstrual flow, accompanied by rise in temperature and general malaise.

Patient was put on tuberculin treatment, and under that treatment showed marked general improvement. Dysmenorrhœa is not so severe. On December 21, 1908, the patient had one of her attacks of cramps again, and on the following day began to menstruate for the first time in three years, the menses lasting seven days; no more premenstrual or menstrual rise in temperature.

The following case will illustrate the effect of out-of-door treatment in sanatoriums:

Phipps' Dispensary, No. 4630. Esther S., aged fourteen years. Admitted July 8, 1909, complaining of cough and expectoration.

Physical examination showed tuberculous involvement of the right upper lobe, and a suspicious left apex. The patient has been menstruating irregularly for some time previously to the onset of the previous illness. The menses gradually subsided, with complete suppression for two months previous to admission to the Dispensary. Patient was sent to the Jewish Hospital for Consumptives, and there improved greatly. Cough and other symptoms cleared, the physical signs faded; she gained weight. Simultaneously with the general improvement, she began to menstruate, and her periods have been regular ever since.

2. THE INFLUENCE OF MENSTRUATION ON THE COURSE OF TUBERCULOSIS.—In considering the influence of menstruation on the course of tuberculosis, we must bear in mind certain fundamental facts in regard to the physiology of menstruation and in

particular two important points. In the first place menstruation does not consist merely in a catamenial flow; far more than that, the local phenomena are accompanied by most profound constitutional changes. In the second place, all these phenomena have a rhythmic periodic character. That the menses are accompanied by various subjective symptoms, even in otherwise healthy women, making them feel "unwell," is too well-known to dwell upon. Schäffer¹⁴ found that out of two-hundred and twenty healthy subjects, about 74 per cent. complained of various subjective symptoms, 14 per cent. of them suffering to a pathological degree. Maria Tobler¹⁵ obtained very similar results. The symptoms are both local and in distant organs, too numerous to mention. But besides these subjective phenomena, important metabolic and other physiological changes have been found to accompany the menstrual act. As early as 1870, Rabuteau¹⁶ and later, Goodman¹⁷ (1876) and Mary Putnam Jacobi¹⁸ (1881), called attention to a wave-like or cyclical cause in metabolism corresponding to the menstrual type of woman. These were followed by a host of other observers. Kersch and Rein¹⁹ (1882-1884) studied changes in temperature; von Ott²⁰ (1890) studied the temperature, pulse, blood-pressure, lung capacity, inspiratory and expiratory power, and reflexes; Schrader²¹ (1894) studied nitrogen elimination; Ver Eecke²² (1897) studied the output of urea, phosphates, and chlorides; Sfameni²³ (1899) found changes in the hemoglobin content at the time of menstruation; Wiessner²⁴ (1899) and Merletti²⁵ (1900), Siredey²⁶ and Francillon²⁷ (1905) studied changes in blood pressure. All of these and other observers found that these various functions and physiological processes follow a rhythmic and periodic like character, and, in general, with a few exceptions, the form of a curve given by von Ott, which shows that these functions undergo a gradual rise in force and energy attaining the maximum just before the flow, and then dropping with the course of menstruation to rise again afterward. What the cause of this periodicity may be, what relation it may bear to the changes in the ovary and the uterus, whether the changes are excited reflexly through the nervous system or through the blood, whether they have to do with an internal secretion of the ovaries, and whether the fall in the curve is due to the setting free of toxins, would take us too far from our subjects. It would bring us into a discussion of the

¹⁴ Chapter on Menstruation in Veit's Handbuch.

¹⁵ Monatsschr. f. Geb. u. Gyn., xxii, 1.

¹⁶ Cited in Veit's Handbuch.

¹⁷ Cyclical Theory of Menstruation, Amer. Jour. Obst., October, 1878.

¹⁸ The Question of Rest for Women, New York, 1877.

¹⁹ Volkmann's Samml. klin. Vorträge, 1884, No. 243.

²⁰ Internat. Kongress, Berlin, 1890. Zentralbl. f. Gyn., 1890.

²¹ Ztschr. f. klin. Med., 1899, xxxv. Cited in Veit's Handbuch.

²² Cited by Schäffer in Veit's Handbuch.

²³ Ref. Zentralbl. f. Gyn., 1899, p. 1311.

²⁴ Ref. Zentralbl. f. Gyn., 1899, p. 1335.

²⁵ La funzione mestruale. Cited in Veit's Handbuch

²⁶ Ref. Wien. klin. Woch., 1905, p. 553.

²⁷ La puberté chez la femme, Thèse de Paris, 1906.

relations of ovulation and menstruation and other much mooted questions. Suffice it to remember that in menstruation the catamenial flow goes hand in hand with tremendous metabolic and other constitutional changes, and that these changes follow a rhythmic character. It is these constitutional upheavals, or molimina menstrualia, that play a most important part in disease in general and in tuberculosis in particular.

If we study carefully any definite tuberculous case in a female, taking careful and repeated notes of all symptoms and signs over a period of several months, we shall in most cases find a rhythmic periodic amelioration and aggravation of symptoms and signs corresponding very much indeed with von Ott's menstrual curve (Fig. 1). This fact has been casually noted quite a long time ago.

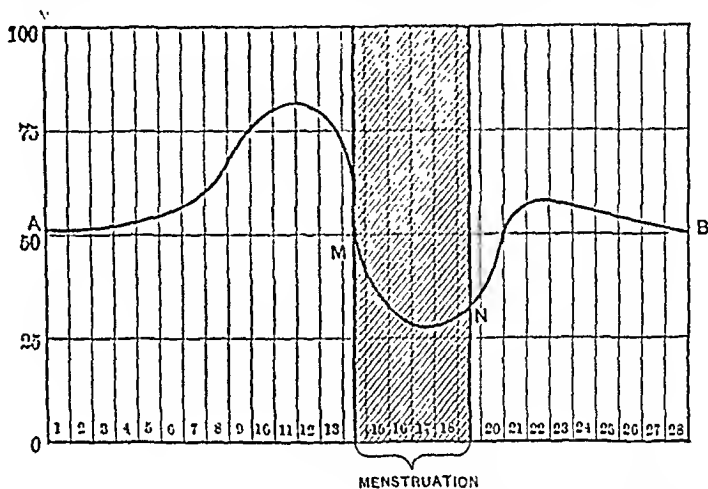


FIG. 1.—Von Ott's menstrual curve, to show the variations of certain physiological functions in women in relation to menstruation. The figures at the bottom represent the four week periods; the figures at the left-hand side represent the intensity of the physiological functions. Beginning at A, there is a gradual rise in the intensity of the various functions, which reach their highest point just before the onset of menstruation, M; there is then a rather abrupt drop, the lowest degree of activity being found in the middle of menstruation. Toward the end of menstruation there is a rise, which is rather rapid at first, but soon lessens.

Laennec²⁸ mentions it; Raciborski²⁹ (1868) and Lorey³⁰ (1875) speak of such cases. But it was not until 1880 that Daremberg³¹ first took up the subject seriously and treated it scientifically. His work is the starting point of most later observers.

At the time of menstruation all the symptoms in a phthisical patient are markedly aggravated. Catarrhal symptoms are increased in intensity. Cough is redoubled and more distressing; expectoration is more profuse, and the sputum may be more purulent and blood-tinged. Dyspnoea is more marked. There is anorexia, and general malaise. Laryngeal tuberculosis takes a rapid turn for the worse. At the same time the physical signs also are more distinct and alarm-

²⁸ Ed., 1879, pp. 170-171.

²⁹ *Traité de la Menstruation*, Paris, 1868. Cited by Noncher and Daremberg.

³⁰ *Thèse de Paris*, 1875.

³¹ *Archives générales de médecine*, 1880, p. 562.

ing. There are signs of pulmonary congestion; the breath sounds are harsher and more exaggerated; rales may be heard, where they were not noted before; rales that were distinguished before, may be more numerous; and dry crepitation may become moist—the whole tuberculous process seems to take a sudden flare-up, very much like that following a large dose of tuberculin. Indeed, all these signs warn us to be exceedingly cautious with the administration of tuberculin at this time, a fact which has perhaps not been enough emphasized, though recently P. K. Pel³² and others have called attention to it.

These exacerbations at the time of menstruation may be transient, and subside with the menses; or they may work permanent injury and hasten the downward course of the disease. More than that, these periodic constitutional disturbances may persist even in amenorrhœa, that is, after the menstrual flow has ceased. In other words, we may have "ovulation without menstruation," and correspondingly exacerbations of the tuberculous process without menstrual flow. Such a case was No. 4402 described above. Such cases were especially studied by Daremberg, whose work on the subject is fascinating reading.

Two phenomena in particular play a remarkable and interesting part in tuberculosis at the time of menstruation, and deserve especial attention. They are periodic *rises in temperature* and periodic *hemoptyses*.

Rises in Temperature. The heat-regulating apparatus in woman seems to be peculiarly unstable at the time of menstruation. Sudden changes of temperature, with chills and fever at that time, may be brought on by a great many causes. We might almost speak of a "febrile neurosis" occurring in women at these periods. These changes in temperature have been noted from the earliest times. Some 1900 years back we find mention of them in the Talmud. The Hebrew laws, as is known, are very exacting in regard to the separation of husband and wife, at the time of menstruation. The Hebrew sages, therefore, made a very careful study of all the prodromal and premonitory symptoms of approaching catamenia. One of the rarer symptoms mentioned is "Zemarmoreth,"³³ spoken of later also as "Kaddachath,"³⁴ both of which would mean fever and chills.³⁵ The subject was not studied scientifically, however, until a very recent date, indeed, not until 1906, when Riébold published his papers on "Menstrual and Prämenstrual Fieber."³⁶ Riébold studied a large number of cases (2000) and found that a rise in temperature at the time of menstruation may occur in a great variety of pathological conditions. He found it in the case of acute and chronic infections. He found it in endometritis and other affections

³² Berl. klin. Woch., 1909, No. 38.

³³ Talmud, Babylonian. Tract. Niddah. Mischna 6.

³⁴ Yoreh Deah. Ed. Wilna, Sec. Niddah.

³⁵ Israëls, A. H., Tenatmen Historico Modicum. ex Talmude Bablonico, 1845.

³⁶ Deut. med. Woch., 1906, Nos. 11 and 12, Prämenst. Temp; Ibid., No. 28 Menst.

of the uterus and its appendages, which probably most gynecologists of experience can corroborate. He found it in tabes, and in carcinoma ventriculi. Some observers, like Reinl and Jacobi went so far, indeed, as to declare that a menstrual rise in temperature may occur in women in normal health. Riébold has, however, pretty conclusively shown that this is not true, and that in every case there is some underlying diseased condition. In no condition, however, is a menstrual rise in temperature of so frequent and constant occurrence as in tuberculosis. In tuberculous patients, if one studies their temperature charts carefully, it is very common to find a rise in temperature about the time of menstruation. References to this interesting phenomenon in literature, however, cannot be found until Turban's³⁷ work in 1899. Later the subject was carefully investigated by Riébold, Seherer,³⁸ Kraus,³⁹ Sabourin,⁴⁰ Noncher,⁴¹ and Mantoux.⁴² All those who have studied the subject are struck by the constancy and regularity of these periodic menstrual exacerbations in temperature and differ only as to the frequency of its occurrence. Whereas Riébold thinks it comparatively rare, occurring only in about 12 per cent. of tuberculous patients, and Scherer claims to have observed it only in advanced cases, Sabourin declares it extremely common, Noncher finds it in about 50 per cent. of cases examined, and Kraus holds that it may be observed in two-thirds of tuberculous patients. These difference in figures are due in the first place to the carelessness in temperature observations, and secondly, as Mantoux suggests, to the disregard of relative rises in temperature. Mantoux claims, as he puts it, that we may have fever without hyperthermia. It is the relative rise in temperature during menstruation that is of importance. We often meet with tuberculous patients, running a normal and even a subnormal temperature, and yet, whose temperature rises a degree or two at the time of menstruation.

I have tried to study the subject among our patients. Obviously only those patients were available who kept careful diurnal records of their temperature. Such were some of our tuberculin patients, a few patients at Eudowood, and a few of my private patients. Out of forty cases thus studied, about 20 or 50 per cent. showed periodic monthly exacerbations.

The rise in temperature may occur in afebrile patients, that is, patients who ordinarily run no fever, as well as in those who run a slight temperature through the month. These rises may occur in early cases as well as in advanced, and in the former, are of considerable diagnostic importance. If a patient shows a constantly recurring monthly menstrual rise in temperature, and pelvic disease can-

³⁷ Beiträge zur klinik der Tuberkulose, 1899.

³⁸ Prämenstruelle Lungenblutungen, Brauer's Beiträge, vi, 287.

³⁹ Wien. med. Woch., 1905, No. 13.

⁴⁰ La réaction thermique chez les tuberculose, Revue der méd., 1905, p. 275.

⁴¹ Thèse de Paris, 1906. (Contains bibliography.)

⁴² Revue de la tuberculose, October, 1905, p. 400.

not be found, a tuberculous process should always be borne in mind. Indeed, a Russian observer, Geisler,⁴³ claims to have diagnosticated cases of tuberculosis, in which no physical signs were demonstrable, by this sign alone.

Fig. 2 illustrates these monthly rises in temperature. Such charts, owing to their length, extending over a period of several months, are plotted by marking the highest temperature registered each day. This chart also shows the monthly fluctuations in the blood pressure, as shown by the upper curve. Of that I shall have more to say later. Fig. 3 shows the monthly exacerbation in an otherwise practically afebrile patient.

Prognostically, these rises in temperature, if very high, are of evil omen; on the other hand, if these periodic rises in temperature grow less, or disappear altogether, it is a sign of a cured or an arrested condition. Such cases I have observed both among our tuberculin and our sanatorium patients.

These febrile rises in temperature may be of different types. Perhaps the commonest form is the premenstrual rise, which may occur a day or two before the menstrual flow, and which corresponds to von Ott's curve given before. The rise in temperature, may, however, be also menstrual and sometimes post-menstrual. These three types and especially the premenstrual and menstrual do not admit of distinct separation. Riebold was inclined to regard the premenstrual rise of different etiology from the menstrual. The premenstrual rise he regarded as due to a "Resorptions-Fieber," the result of heightened metabolic activity before the menses; the menstrual rise he regarded as due more to an intoxication by absorption of the menstrual flux. Such a distinction cannot, however, be held, as we find the two types occurring in the same person.

In 1905 Van Voornveldt,⁴⁴ described another type of menstrual fever which he called *Febris Intermenstrualis*. Van Voornveldt reported a patient who instead of showing a rise in temperature at the time of the menses, showed at that time a minimum of temperature, whereas at regular intervals just between her catamenias she exhibited a remarkable periodic rise—truly a *Febris Intermenstrualis*, or intermenstrual fever. The explanation of the phenomenon given by the author, which is probably the correct one, is that these intermenstrual rises in temperature correspond to what the Germans term *Mittel-Schmerz*, and the French, *douleurs intermédiaires*, or intermediary pains. There are some subjects, who instead of feeling unwell at the time of their monthly sickness, enjoy at that time the best of health, and feel at that time better and stronger than at any other time, whereas between their periods they are sick and complain of various pains. Their menstrual curve, so to say, reaches its fastigium at a time intermediate between two menstrual periods. In the same way Scherer speaks of some tuberculous patients who feel better at their menses than at other times. It is to this class that

⁴³ Russki Vrach, 1909, No. 3.

⁴⁴ Zeitsch. f. Tub., 1905, p. 543.

Van Voornveldt's case belongs. I think I have found one patient among our cases who exhibits this curious intermediate exacerbation of symptoms in a moderate degree (Fig. 4).

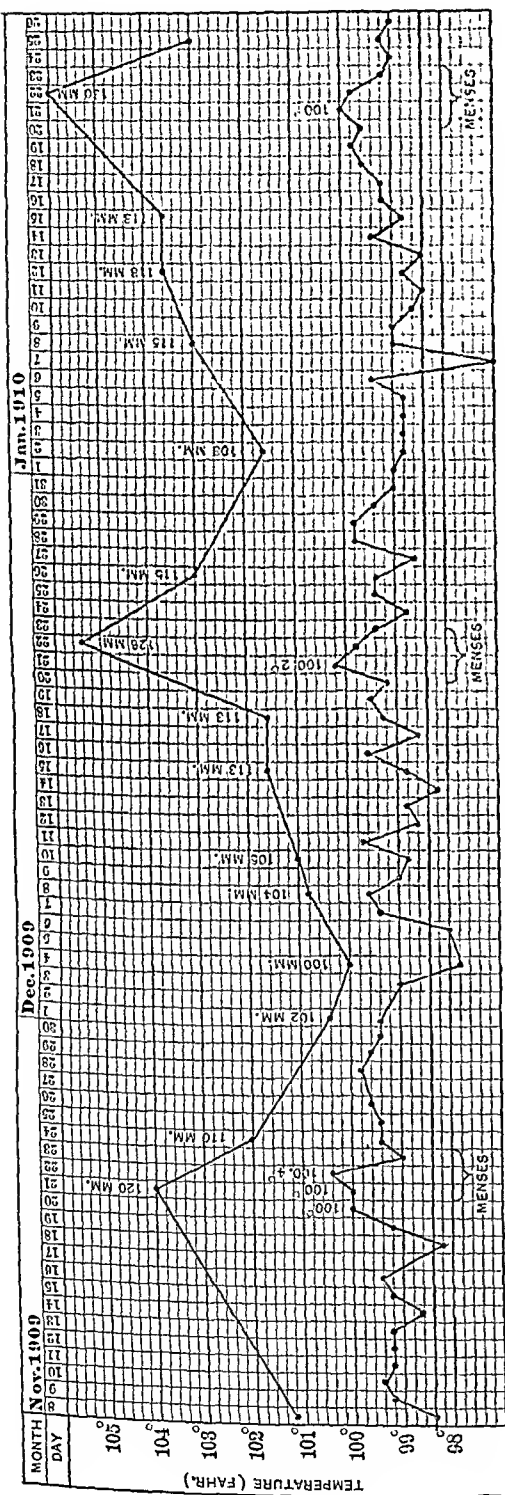


FIG. 2.—The monthly temperature and blood pressure variations.

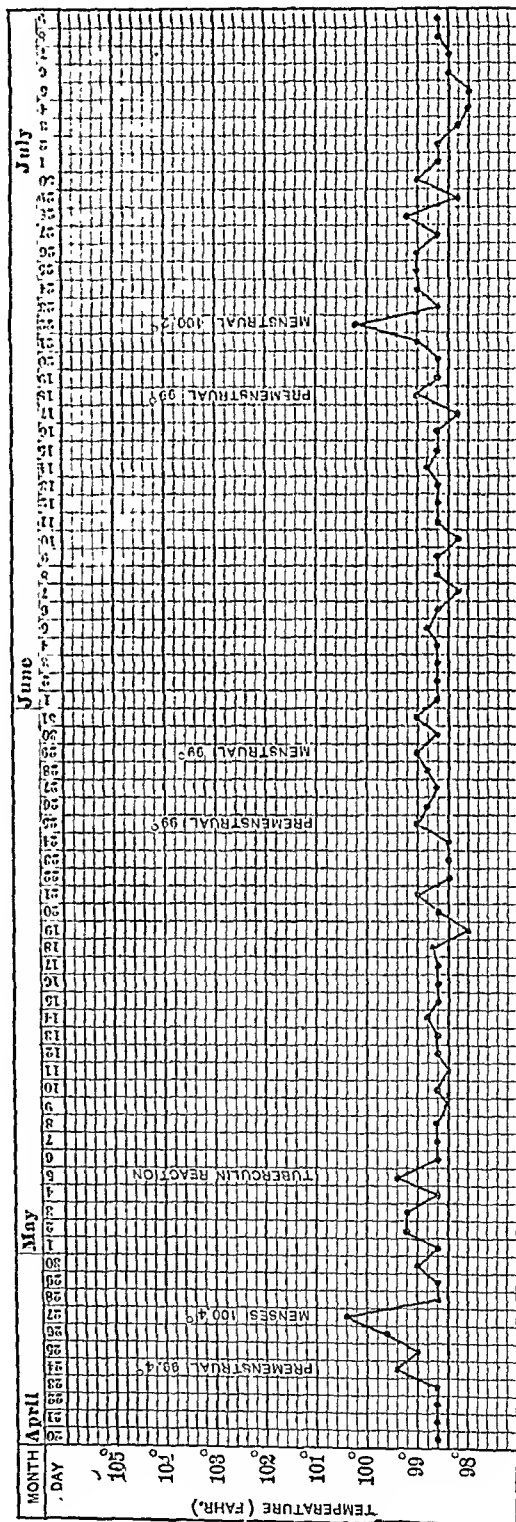


FIG. 3.—Monthly exacerbations of fever in an otherwise practically afebrile patient.

Before leaving the subject it might be interesting to note that though the menstrual are the commonest periodic temperature changes in tuberculous patients, other periodic exacerbations of symptoms in the tuberculous are occasionally met with, not explicable on the same grounds. Thus Gabrilowitsch⁴⁵ speaks of periodic changes corresponding to meteorological conditions. Another curious case is reported by Heimann,⁴⁶ of a tuberculous man with a remarkably periodic cycle of events. These the author ingeniously explains by assuming the existence of "Immunitäts-Vorgänge," "Immunization Processes, and "Immunitäts-Perioden" or Immunity Periods to occur in the course of the disease.

Hemoptysis is a symptom of such a striking and, to the patient at least, alarming character, that it has attracted a great deal of attention, and has been carefully studied. None are more interesting than the so-called periodic hemoptyses. By periodic hemoptysis we mean the expectoration of blood in greater or less quantities, at regularly recurring intervals of time, of longer or shorter duration. Such hemoptyses have been noted by various observers, and they may be divided into three great classes. In the first place, the hemoptysis of intermittent fever or malaria, in the second place, the periodic hemoptysis of tuberculous patients, and in the third place, the hemoptysis of so-called vicarious menstruation.

The cases belonging to the first class are exceedingly rare. The most important are those studied by Widal,⁴⁷ who observed in Algeria a number of malarial patients, who had hemoptysis at the height of the recurring paroxysms of fever. These hemorrhages he thought were due, in part at least, to the marked vascular changes found in the disease. Two other observers, Silberschmidt⁴⁸ and Loewenthal,⁴⁹ noted similar hemoptyses in malarial patients, but their patients had also tuberculous lesions in the lungs, so that their cases really belong to the second class I mentioned, in which we are especially interested, namely, the periodic hemoptyses of tuberculous patients.

A periodic recurrence of blood spitting in tuberculous patients at regular intervals of time, has been noted by a number of observers. Thus Huguenin⁵⁰ speaks of a patient with a characteristic intermittent morning hemoptysis; in other words, a patient who regularly with the first few coughs every morning, expectorated blood, but was free from it during the rest of the day. Gerhardt⁵¹ describes two cases of nocturnal hemoptysis, that is, two patients who regularly brought up considerable quantities of blood soon after midnight.

⁴⁵ Ueber Husten und Blutspeien, Ztschr. f. Tub., 1906, ix.

⁴⁶ Zyklischer Verlauf bei Lungentuberkulose, Brauer's Beiträge, v, 61.

⁴⁷ Hémoptysie, Dict. encycl. des sciences médicales, Paris, 1888, iv, 13.

⁴⁸ Dissertation, Würzburg, 1885.

⁴⁹ Zentralbl. f. d. med. Wissenschaften, 1889, xxvii, 23.

⁵⁰ Lungeblutungen, Korrespondenzbl. f. Schweiz. Aerzte, 1898, xxviii, 97.

⁵¹ Intermittierende Nächtliche Hämoptoe., Deut. Zeitsch. f. prak. Med., 1874, p. 369.

Brehmer⁵² saw three patients with regularly recurring hemoptysis at intervals of one, two, and five to six weeks respectively; and Litzner⁵³ writes of a man who regularly coughed up large quantities of blood at intervals of three to four weeks. The explanations for such periodic hemorrhages have never been satisfactory. Some, as Gerhardt, tried to trace the relation between the hemoptysis and intermittent fever; others, like Nelson,⁵⁴ attach importance to fluctuations in barometric pressure. Heimann, as already mentioned, speaks of intermittent "immunizing processes," and others, as Gabrilowitsch, would lay the blame on meteorological conditions. Undoubtedly, however, the most important and the most easily explainable periodic hemorrhages in tuberculous patients are the menstrual hemoptyses.

When we bear in mind the tremendous constitutional upheaval and disturbances in physiological functions taking place in woman at the time of menstruation, it is not at all surprising to find that tuberculous patients spit blood at that time. Such cases have been reported by Tiedeman⁵⁵ Scherer, Kober,⁵⁶ Davis,⁵⁷ Flesch,⁵⁸ Ford,⁵⁹ Darenberg, Lawson Tait, Schlippe,⁶⁰ and others, but have always been regarded as rareties. Only recently in the *Revue de la tuberculose*, two observers, Mosny and Stern,⁶¹ have written a whole thesis on two cases of consumption with periodical hemoptysis at menstruation. Now I think that such cases are by no means so rare as reported. On looking over our cases, I have found at least fifteen patients with a history of more or less hemoptysis occurring at their periods; and I am sure that had we looked for them, many more cases could have been found. Here, as with menstrual temperatures, the trouble is that we never think of this association of phenomena. The following is a typical case:

Phipps' History, No. 2247. Mrs. Louise C., aged thirty-five years; white. Admitted December 11, 1907, complaining of "chest trouble."

On physical examination, I found advanced tuberculous involvement of the left lung with some infiltration of the right upper lobe. The disease progressed slowly but surely. The patient was menstruating at first regularly, but later became amenorrhœic. At the same time she complained of expectorating blood regularly every month at her periods. One month the menstrual flow did not appear at all,

⁵² Die Intermittierende Hämoptoe bei Phthisikern, Deut. Zeitschr. f. prak. Med., 1875, No. 12.

⁵³ Referat Z. f., 1905, p. 259.

⁵⁴ Hemoptysis in Relation to Barometric Pressure, Medical Record, February 19, 1876.

⁵⁵ Dissertation, Würzburg, 1842.

⁵⁶ Ueber Vikar. Menstruation durch. die Lungen, Berl. klin. Woch., 1895, No. 2.

⁵⁷ Vicarious Menstruation, Lancet, 1884, xi, 782.

⁵⁸ Tödliche Lungenblutung während der Menstruation, Zentralbl. f. Gyn., 1890, No. 37.

⁵⁹ Two Cases of Vicarious Menstruation, Amer. Jour. Obst., 1889, p. 154.

⁶⁰ Ueber periodisch Auftretende Hämoptae, Brauer's Beiträge, viii, 277.

⁶¹ Revue de la tuberculose, October, 1909.

and on that account the hemorrhage from the lungs was exceptionally profuse and prolonged. The patient actually died from exhaustion after one of these periodic hemoptyses.

Similar cases, more or less marked and of more or less frequent recurrence, were noted among our Phipps' Dispensary patients Nos. 375, 3127, 3790, 4893, 4328, 3899, 4628, 5681, 5362, 2429, three or four at the Eudowood Sanatorium, and two of my private patients.

These menstrual hemorrhages may be very slight, consisting of small amounts of blood, and again they may be profuse, and even fatal, as in the case reported by Fleisch. These periodic hemoptyses may persist even after the patient has improved in health, and the tuberculous process become arrested. Thus, Dr. Victor F. Cullen writes me of a case he had at the Maryland State Sanatorium, of a young girl, who "just as regularly as she menstruated every month, would have a hemorrhage, and this kept up in spite of everything we could do." The explanation of these hemorrhages is not hard to find, if we bear in mind the increased blood pressure, and congestion of the internal organs occurring at that time. An additional factor is probably the change in the vessel walls noted in tuberculous patients.

These periodic hemorrhages may occur simultaneously with the menstrual flow; they may also occur with suppression of menstruation, and become what has been termed, vicarious hemoptyses. Such vicarious hemorrhages from the lungs have been formerly regarded as prognostically favorable, in the sense of "giving vent to the bad blood." This, of course, is a very wrong idea, and it is our duty to try to prevent such hemorrhages as much as possible. Dr. H. Warren Buckler tells me of a case he and Lawrason Brown had at Saranac, of a consumptive girl, who had such vicarious hemoptysis, with suppression of menses. The patient improved rapidly, as far as her lungs went, under out-of-door treatment, but these periodic hemorrhages persisted until she finally literally "bled to death."

Periodic hemorrhages in consumptives at the time of menstruation, may take place from organs other than the lungs. Thus Wilson⁶² and Newman⁶³ have reported such hemorrhages from the trachea, and upper respiratory passages. Recently I myself⁶⁴ reported a rather interesting case of a woman with pulmonary tuberculosis with intestinal complications—ulcers in the bowel—who regularly had severe hemorrhages from her intestines at her periods. Fig. 5 illustrates these periodic hemorrhages from the bowel, together with the menstrual variations in temperature.

⁶² Bleeding from the Trachea, *Brit. Med. Jour.*, 1884, i, 992.

⁶³ Repeated Hemoptysis, *Brit. Med. Jour.*, May 29, 1897.

⁶⁴ *Medical Record*, February 26, 1910.

Speaking of periodic hemoptysis, we must touch upon that most interesting and much discussed phenomenon—vicarious menstua-

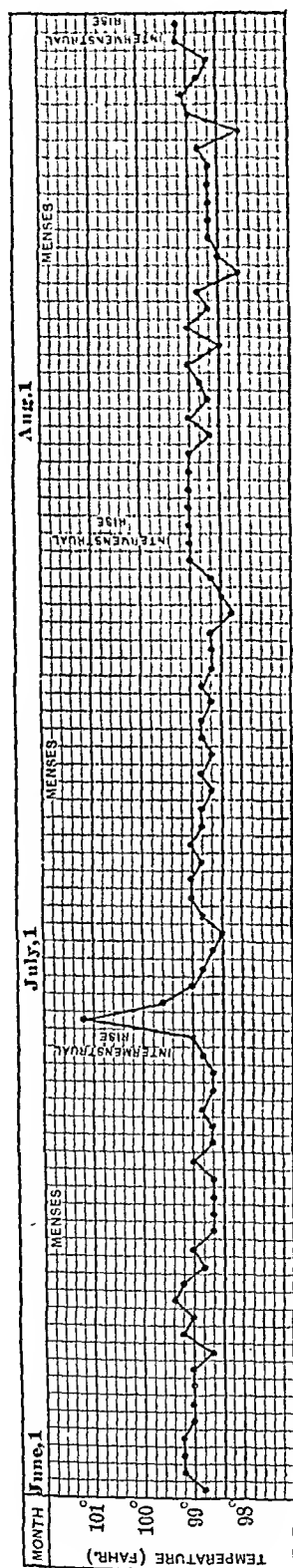


FIG. 4.—Intermenstrual rise of temperature.

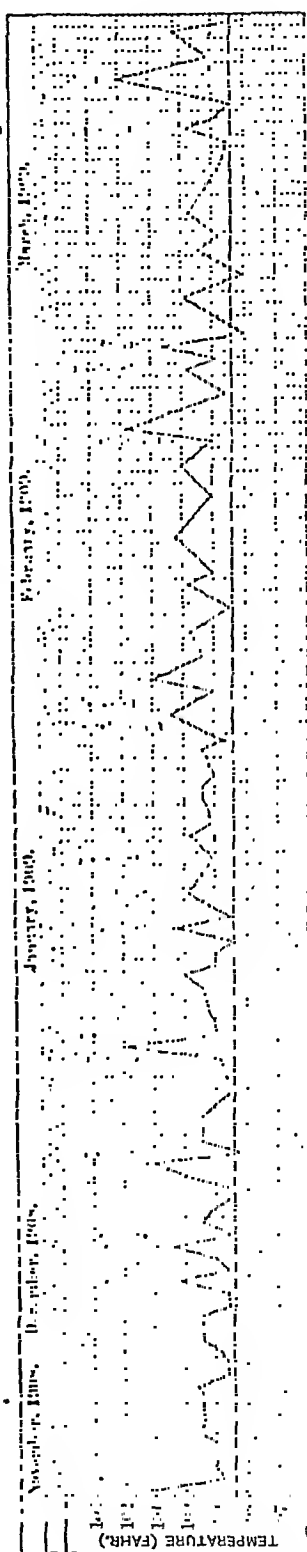


FIG. 5.—Periodic hemorrhages from the bowel, with menstrual variations in the temperature. (The chart has been reproduced through the courtesy of Messrs. Wm. Wood & Co.)

tion. By vicarious menstruation we mean periodic hemorrhages from organs other than the uterus, accompanying or replacing entirely the regular menstrual flow. Numerous such cases have been reported, some well authenticated, others of doubtful authenticity. Thus such periodic bleeding has been described to have taken place from the nose, gums, eyes, ears, stomach, kidneys, breasts, and recently even from the lips (Hauptman⁶⁵). The hemoptyses spoken of previously may appropriately be regarded as a form of vicarious menstruation. It is customary, however, to restrict the term vicarious hemoptysis to such cases of bloody expectoration in which no pathological lesion in the lungs is demonstrable, and the pulmonary parenchyma is apparently intact. This has given rise to quite a controversy, which up to the present time has not been definitely settled. On the one hand, we have such observers as Gallard, Leibermeister,⁶⁶ Ruhle,⁶⁷ Davis, Lawson Tait, and Lenhartz,⁶⁸ who deny the existence of such vicarious menstruation, and who assert that in all the cases reported a lesion of the lungs could not possibly be excluded. On the other hand, there are others, such as Widal, Seitz,⁶⁹ Teideman, Wiltshire,⁷⁰ Schlippe, and others, who just as emphatically declare for the existence of such cases. The question could be easily settled had we a number of cases with postmortem findings. Unfortunately, or fortunately, none of the cases, except one, have come to autopsy, and we must draw our conclusions mostly from the clinical histories and physical findings of the cases. Some of the clinical histories, however, are so striking as to admit of very little doubt. Thus in Becker's case,⁷¹ a woman, aged thirty-two years, had sudden suppression of menstruation following a fall into the water. With the suppression of menses, she began to expectorate blood every four weeks, regularly, without any other symptoms or physical signs. She became pregnant; the hemoptyses stopped. She nursed her child; there were no hemoptyses. After weaning the baby, the hemoptyses returned. Hoffman's case, reported by Sticker,⁷² is very similar. A woman, aged thirty years, had suppression of menstruation, brought on by great fright. Periodic hemoptysis followed, which disappeared during pregnancy, to reappear again, even while nursing, before the child was weaned. The patient remained permanently well. Similar cases have been reported by Ford, Wiltshire, and others.

By far the most striking and convincing cases, however, is a series reported by an Italian observer, Claudio Ventura,⁷³ of vicarious hemoptysis occurring in three successive generations of the same family.

⁶⁵ Münch med. Woch., October 29, 1909.

⁶⁶ Vorlesungen über spez. Path. u. Therapie, 1881, iv, 117.

⁶⁷ Die Lungenschwindsucht, Ziemssen, 1874, v.

⁶⁸ Erbstein-Schwalbes Handbuch, i, 303.

⁶⁹ Lehrbuch der spez. Path. u. Therapie, i, 148.

⁷⁰ Cited by Tiedman.

⁷¹ Gazzetta degli Ospedali, 1907, No. 129.

⁷² Lancet, 1885, i, 513.

⁷³ Hoffman's case, Nothnagel, xiv, 29

In the first generation there were three sisters, one of whom had this vicarious hemoptysis. The two other sisters, who were perfectly well, married and gave birth to five daughters. Of this second generation, two daughters had vicarious hemoptysis. One of these married and had four children. They were the third generation and of these two girls had vicarious hemoptysis. In none of the cases was there any history of syphilis, or tuberculosis, or hemophilia, or cardiac disease. Three of the patients were carefully observed and repeatedly examined by experienced physicians.

Very recently, I have had the good fortune to note a somewhat similar history in the Phipps' Dispensary:

CASE No. 5681. Ida B., aged thirty-four years; white, single; comes to find out whether she has tuberculosis or not. The reason is because she expectorated blood at her last period. On questioning her I obtained the following history: Menarche at eighteen years; periods at that time were very scanty, occurring regularly every six weeks, and accompanied by great pain. At the same time, for many years, patient used to spit "mouthfuls" of blood at the time of her menses. Periods now come every month, and last three to four days; patient has had no hemoptyses for several years, until last period, about ten days ago. At that time her menses were less than usual and more painful, and immediately after the cessation of the flow, she had a hemorrhage from the mouth.

Physical Examination: No definite physical signs. Eye and skin tests: Skin test slightly negative; eye tests negative.

These tests would seem to indicate that the patient probably had a slight lesion in her earlier days, which healed up. Patient was accompanied by her sister. This sister, though not a patient, on hearing my questions, informed me that she, too, has, and still does spit blood at her periods.

This patient, Phipps' Case No. 5696, on examination gave more suspicious signs of tuberculosis. Furthermore, I learned that a daughter of hers had also periodic menstrual hemoptyses.

I could not obtain a further history of blood spitting in the family. There was, however, a history of their mother dying of consumption. In this case, therefore, we cannot exclude tuberculous infection, so that even Ventura's cases would seem to be not unimpeachable.

Finally, however, in 1907, Riébold⁷⁴ reported a case of menstrual hemoptysis that came to autopsy, in which no lesion in the lungs could be found.

I think, therefore, we may pretty safely conclude that vicarious hemoptysis, in the strict sense of the word, does occur. Such cases, however, are extremely rare, and in every case we should be very cautious about excluding a tuberculous lesion.

I have dwelt rather at length on the subject of the influence of

⁷⁴ Deut. med. Woch., 1907, p. 1870.

menstruation on tuberculosis because it is not only of scientific but also of practical importance. We have seen that tuberculous female patients undergo periodically tremendous constitutional upheavals which aggravate the tuberculous process, often awake a dormant lesion, increase the catarrhal symptoms, cough, and expectoration, cause the temperature to rise, and lead to congestion of the lungs and hemoptyses. Can we do anything to check these ravages, which of en undo the good of a month's nursing and treatment, in the space of a few days?

Although very little work has been done on the subject, I wish to state that we can do a great deal to minimize the danger, and even to prevent harm entirely. In the first place prophylactically, I wish to emphasize strongly against the administration of tuberculin prior to or during the menstrual period. It has been found time and again, that even minimal doses of tuberculin will cause a rise in temperature and a reaction in patients who ordinarily take large doses of the drug for therapeutic purposes. Second, the question of rest for tuberculous women at this time is of paramount importance. Third, we may help things a good deal through rational therapy. Congestion of internal organs, with consequent hemoptysis or other untoward symptoms may be prevented or lessened by suitable revulsants, foot baths, and other hydrotherapeutic measures. The extreme irritability of the nervous centers should be depressed by suitable nervines, especially the bromides. A rise in temperature may be avoided by the administration of liquor ammonii acetatis, which promotes diuresis and diaphoresis, reduces the temperature, and at the same time seems to have some emmenagogal properties. If the pulse is rapid, circulatory sedatives are recommended by Daremberg. The bowels should be kept freely open, and other symptoms treated as they arise. In this way, danger can be avoided, and harm minimized.

The following private case of mine will well illustrate the point. The patient, Miss M. K., aged twenty years, has a moderately advanced lesion of the left lower lobe. There is practically no cough nor expectoration. The chief symptoms were progressive weakness and loss of weight. The patient's temperature is usually normal and even subnormal, except about the time of the menses. Under general out-of-door treatment, together with small doses of tuberculin (O.T.) she improved nicely. Symptoms became less marked, rales less in number, and she increased in weight. Every month, however, the benefits of the month's treatment are destroyed with the approach of the menstruation. The patient becomes extremely ill, has high temperature, cough appears, she has severe pain in the back and abdomen, and has to go to bed. The physical signs also become exaggerated.

I tried to abate these attacks, by ordering rest in bed a few days previous to the onset of catamenia, and prescribing the patient

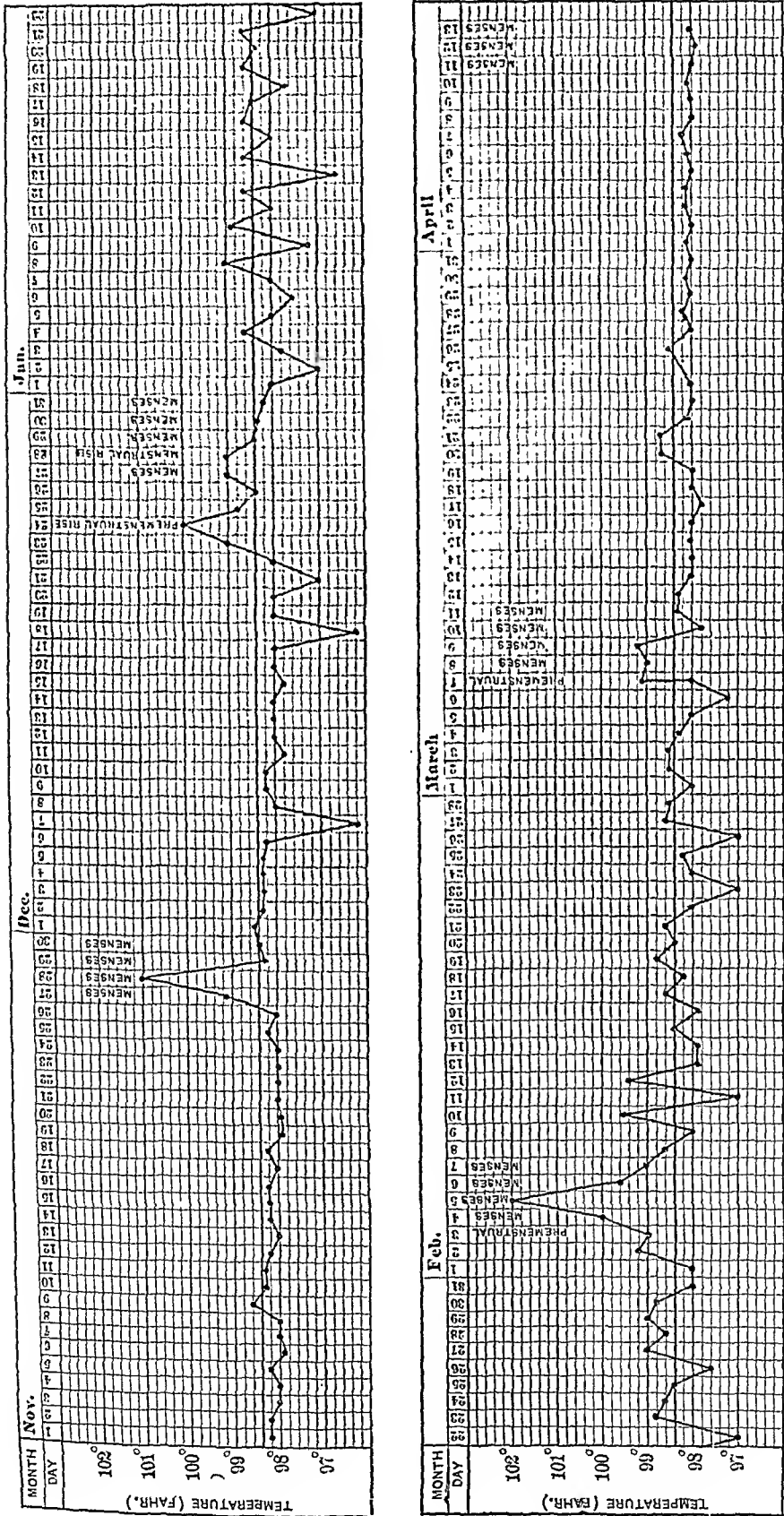


Fig. 6.—Illustrating the influence of treatment on the premenstrual and menstrual fever.

a mixture of full dose of sodium bromide, spirits of nitrous ether, and solution of ammonium acetate. This the patient took until the menses were over. The result is shown by the curve in March and April (Fig. 6). The rise in temperature was but slight, the pains were very much less than before, and in general the patient herself was surprised at her good condition.

These measures should be begun well before the onset of the menstruation. Unfortunately, however, it is not always easy for the physician, and not even for the patient, to foresee its approach, especially when the menstruation is irregular, as it is liable to be in these cases. In such cases, I have found great help from the observations of the patient's blood pressure. The blood pressure has been found by Siredey and Francillon, and recently by Tsuji,⁷⁵ to increase gradually, up to the time of menstruation, and then suddenly fall. With this in mind, I have made observations on three patients, taking their blood pressures as often as possible, and I have found that I could with pretty fair accuracy foretell the approach of menstruation by the rise of blood pressure preceding it. Indeed, a number of times, I warned the patients of its approach before they themselves were conscious of it.

Résumé. I. The effect of the tuberculous process on the menstrual function:

1. This is manifested chiefly in changes in the menstrual type.
 - (a) Tuberculous patients may menstruate *regularly* to the end, especially after the age of thirty-five years.
 - (b) The patients may have amenorrhœa, passing into complete suppression of the menses.
 - (c) Quite an appreciable number, 4.6 per cent., may have menorrhagia preceding the amenorrhœa.
2. The age of the patient is the most important factor in these conditions.
3. Some cases of dysmenorrhœa are of a purely tuberculous origin, and are relieved by tuberculin treatment.
4. The effect of treatment in general is to restore a normal type of menstruation.
5. The changes in the menstrual type are of considerable diagnostic and prognostic value.

II. The influence of menstruation on the tuberculous process:

1. This is manifested by aggravation of all symptoms, and accentuation of physical signs.
2. The effects of "ovulation" may continue after the menstrual flow has been suppressed.
3. Periodic variations in temperature are very common, occurring in probably 50 per cent. or more of all cases, and are of diagnostic and prognostic value. These rises in temperature may be (a) premenstrual, (b) menstrual, (c) postmenstrual, (d) intermenstrual.

⁷⁵Archiv f. Gyn., lxxxix, 3.

4. Periodic hemoptyses and other hemorrhages in tuberculous patients are more common than is generally assumed. These hemoptyses may occur simultaneously with the menstrual flow, or may take the place of the menstrual flow.

5. True vicarious menstruation does occur, but is exceedingly rare, so that in most cases of vicarious hemoptysis a tuberculous lesion is to be suspected.

6. Tuberculin should not be administered at the time of menstruation.

7. The evil effect of the menstrual processes on the patient's constitution can be minimized by proper treatment.

In conclusion, I wish to express my obligation to Dr. Hamman, of the Phipps' Dispensary, for valuable suggestions; to Dr. Sloan, of the Eudowood Sanatorium; to Dr. Victor F. Cullen, of the State Sanatorium, for permission to use their material, and last, but not least, to the nurses, Mrs. R. Foster and Miss McIntyre, for valuable aid in studying patients on this delicate subject.

THE INCIDENCE AND SIGNIFICANCE OF SMOOTH (OR INDURATIVE) ATROPHY OF THE BASE OF THE TONGUE.

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For a number of years pathological anatomists have recognized the frequent association of syphilis with changes at the root of the tongue characterized by obliteration of the normal surface markings and by unusual smoothness and induration of the tissues in that vicinity. Virchow, in his lectures and demonstrations on the pathological anatomy of acquired syphilis, repeatedly referred to a condition which he designated "smooth atrophy of the base of the tongue" (*atrophia levis basis linguæ*), and gave expression to the conviction that there is a causal relation between it and syphilis.

Neither the clinical nor pathological significance of these changes received systematic consideration until the appearance of a paper by Lewin and Heller in 1894. These investigators, stimulated by Virchow's observations, examined the autopsy records in 6583 cases, extending over a period of seven years, and found anatomical confirmation of the existence of syphilis in 200 (3 per cent.) of the total number of bodies examined. In 103 (1.5 per cent.) smooth

atrophy of the base of the tongue was present, and of this number, 71 (69 per cent.) were in syphilitic subjects. In 32 individuals (31 per cent.) the base of the tongue was atrophic, but anatomical evidences of syphilis were lacking. In only 2 instances did these authors meet with smooth atrophy of the tongue in early syphilis—once in association with an indurated ulcer of the penis and once in a similar lesion of the vagina. They could trace no relationship between hereditary syphilis and the lingual lesion in question. In fact, they advanced the view that the histological alterations in smooth atrophy of the tongue represent the conclusion of an interstitial fibrosis following ulcerating gummas, and that the lesion is practically always a late sequence of acquired syphilis. With the exception of the 2 cases just mentioned, the anatomical diagnosis of syphilis was based upon the occurrence of such lesions as gummatous meningitis and encephalitis, cicatrices in the pharynx, larynx, liver, kidneys, and intestines, chronic interstitial pneumonia, interstitial hepatitis and orchitis, and late syphilitic lesions in the osseous system.

In Lewin and Heller's series, 62 per cent. of the subjects were over forty years of age, and in syphilitic women smooth atrophy of the tongue occurred somewhat more frequently than in men—a fact which they attributed to the circumstance that in women the secondary manifestations of syphilis are frequently overlooked or misinterpreted, so that treatment is neglected and the patients thus rendered unusually susceptible to the development of tertiary lesions.

In 166 cases of smooth atrophy of the base of the tongue Lesser was able to determine anatomical evidence of syphilis in 73 instances (44 per cent.); in 17 cases gummas were present in various localities; in 2, condylomata lata; in 23, characteristic scars were observed in the skin, mucous membranes, or sexual organs; and in 21 there were specific interstitial visceral lesions. This investigator, dissenting from the view that smooth atrophy of the tongue is a sequel of the healing of ulcerating gummas, inclines to the belief that it is the result of a chronic interstitial inflammation involving in greater or less degree all of the structures at the base of the tongue. He proposed to designate the process "glossitis levis" rather than "atrophia levis."

In contradistinction to the findings in acquired syphilis, Skladney states that he observed smooth atrophy of the base of the tongue in 20 of 24 cases of late hereditary syphilis. Seifert, on the contrary, was unable to determine the occurrence of this lesion in a single one of 26 cases of late hereditary syphilis. In fact, he found that the lymphoid tissues at the root of the tongue in these circumstances were hyperplastic in 4 instances and that in 3 cases the tongue was apparently normal.

In 71 cases of active syphilis Schötz was able to demonstrate

the presence of various papular and erosive lesions at the base of the tongue, but in no instance was smooth atrophy present. On the other hand, the lymphoid follicles in active syphilis were not infrequently enlarged. Similarly, smooth atrophy was absent in 12 cases of late acquired syphilis, while in 4 such cases the lingual lymphoid follicles were hyperplastic. Of 4 cases of hereditary syphilis, on the other hand, the base of the tongue appeared to be well preserved in 3, while in the remaining case the lymphoid structures were unduly prominent.

In regard to both the clinical and anatomical value of smooth atrophy of the base of the tongue as an indication of syphilis, Goldschmidt assumes a still more radical attitude, and maintains that smoothness of the base of the tongue may represent the expression of defective development of the glandular structures of the organ as a whole, that it is possible for the base of the tongue to share in the general process of bodily degeneration, and that smooth atrophy occurs in persons in whom there can be no reason to suspect syphilis. Thus, he believes that he has seen pronounced atrophic lesions in 2 markedly anemic women and in 1 woman suffering from lupus. For these reasons he holds that smooth atrophy of the base of the tongue per se is an unreliable indication of syphilis, and that it assumes relative value only when it is associated with other signs of previous luetic infection.

In this country N. B. Potter appears to have been the only one to attempt to determine the clinical value of smooth atrophy of the tongue. This observer examined the tongue in nearly 400 individuals, and arrived at the conclusion that when the root is normal it is probably of considerable value in excluding syphilis, that typical smooth atrophy in an individual below fifty years of age points to syphilis, and that a moderate or slightly marked degree of atrophy is of little value in respect of syphilis.

Before proceeding further, it might, perhaps, be of interest to recall that, in normal conditions, the root of the tongue presents on either side of the median raphe between the circumvallate papillæ in front and the epiglottis behind, about a dozen nodular elevations, each of which is rounded or oval in outline and about 2 mm. or 3 mm. in diameter, and presents at its centre a small crypt-like depression. These nodules lie in the connective tissue immediately beneath the stratified squamous epithelial covering of the tongue, and correspond, histologically, with lymphoid follicles in which germinal centres are practically always discernible. Still deeper in the substance of the tongue numbers of mucous glands come into view, but seldom if ever do they approach sufficiently close to the surface to be felt by the finger or to become apparent to the unaided eye. Beneath these structures striated muscle bundles are found. Running between and supporting these several elements are delicate connective tissue trabeculæ.

It appears that at the base of the tongue the lymphoid structures not only share in the hyperplasia met with in these tissues as a whole in secondary syphilis, but that the follicles become enlarged in a variety of other conditions. Thus, in examining the root of the tongue in 30 syphilitic subjects presenting typical secondary manifestations, I was able to note the occurrence of markedly hyperplastic lymphoid follicles in 21 instances, or in 70 per cent. Other observers, as previously indicated, have encountered similar changes in active syphilis. That the condition, however, is by no means limited to syphilis is signified by the fact that in examining the records in 623 autopsies, including 6 cases of status lymphaticus, I found that the lymphoid follicles in the situation indicated were enlarged in 42 instances—5 times in association with pulmonary tuberculosis, 5 times in conditions attended by excessive transudation into the great serous cavities (cirrhosis of the liver, chronic valvular disease of the heart, etc.), and 26 times in acute or chronic septic states, such as croupous pneumonia, ulcerative endocarditis, pyothorax, decubital ulcers, and the like. And it is of some interest to note that in 24 of these 42 cases there was an associated hyperplasia of the lymphoid follicles in the spleen.

Examined by the naked eye the base of the tongue on either side of the median line in such circumstances exhibits from 12 to 25 or more pale, discrete, lymphoid nodules, varying in diameter from 3 mm. to 7 mm., and often so closely aggregated that the intervening epithelial covering is entirely obscured. In rare instances the lymphoid follicles may even assume greater proportions than are indicated by these measurements. Upon microscopic examination it is found that the lymphoid collections are unusually rich in cells and that practically every individual focus contains a germinal area. Neither the underlying glandular nor the muscular tissue nor the superficial epithelial covering appears to suffer atrophic changes as the result of enlargement of these follicles.

In the condition to which Virchow gave the name of smooth atrophy the base of the tongue presents characteristic changes.

In the least advanced cases the base of the tongue is pale, flattened, relatively smooth, and firmer than normal, and the lymphoid follicles are few and small (Fig. 1). In some instances they lie at the periphery of the tongue; in others they may be seen as pin head-sized or slightly larger nodules scattered at remote intervals beneath the epithelial layer. In cases further advanced the lymphoid follicles are invisible to the naked eye, and the surface of the base of the tongue is pale, smooth, markedly flattened, and very firm. In a considerable proportion of these advanced cases the epiglottis is pulled forward or to one side, and not infrequently its free border presents numbers of small indentations. In extremely advanced cases it is said that complete destruction of the epiglottis may occur (Lewin and Heller). On section through the tongue it is

found that immediately beneath the epithelial layer the tissues for about 2 mm. or 3 mm. are pale, often hyaline in appearance.

Microscopic examination of the base of the tongue reveals definite and characteristic histological alterations (Figs. 2, 3, and 4). The epithelial covering is noticeably thinned, while beneath this it is seen that the fibrillar connective tissue of the submucosa has been transformed into a thick, often homogenous, hyaline mass which is irreg-

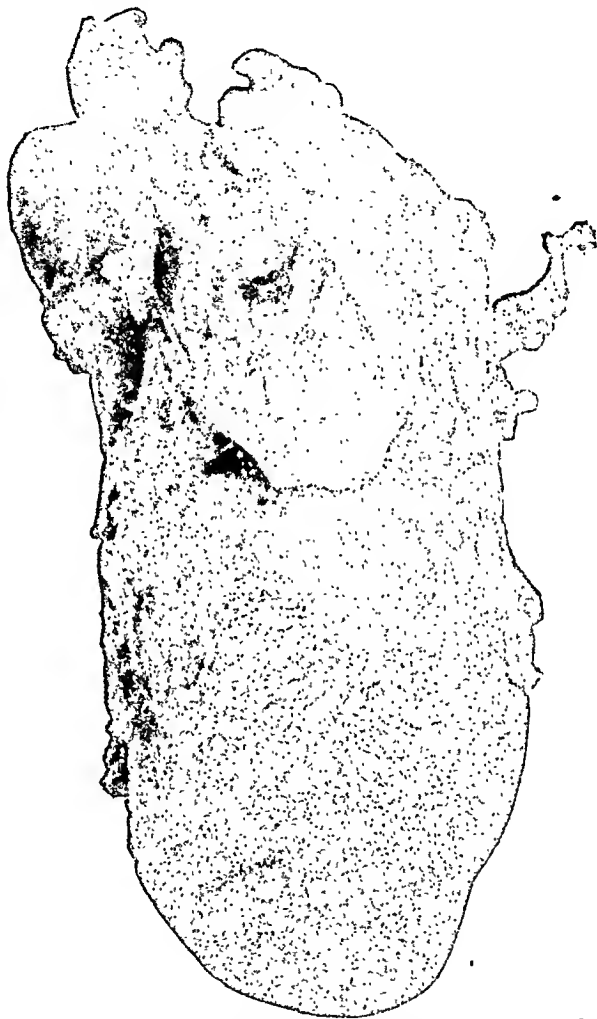


FIG. 1.—Photograph of the tongue in a syphilitic individual, aged thirty-two years, showing typical smooth (or indurative) atrophy of the base. Note the almost complete disappearance of the lymphoid follicles. (Photograph by Dr. Chas. E. Farr.)

ularly vascularized and encloses larger or smaller collections of loosely arranged lymphoid cells. In many instances the lymphomatous foci are definitely embedded in thickened connective tissue, and not infrequently the node itself is permeated by trabeculae derived from the periphery or radiating outward from the thickened walls of vessels lying in the substance of the node itself. In other instances, the lymphoid cells are scattered diffusely through the connective tissue of the submucosa, while in still other instances they have

practically disappeared. Even in the better preserved adenoid collections germinal areas are practically always absent.



FIG. 2.—Low power photomicrograph of a section of the tongue in smooth (or indurative) atrophy, showing thinning of the epithelial layer, atrophy of the lymphoid follicles, disappearance of their germinal areas, and connective tissue replacement of the deeper glandular elements. (Photomicrograph by Dr. H. S. Martland.)

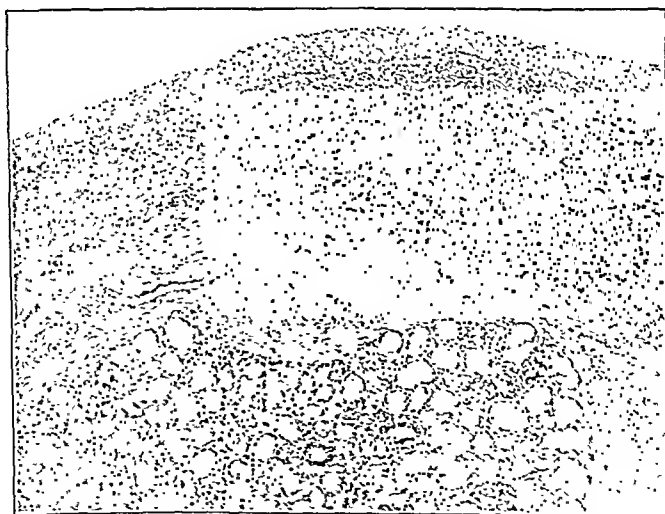


FIG. 3.—High power photomicrograph of smooth (or indurative) atrophy of the base of the tongue, showing widespread connective tissue replacement, diffuse distribution of lymphoid cells with absence of germinal areas, and compression of bloodvessels. (Photomicrograph by Dr. H. S. Martland.)

Running downward from the periphery in an irregular manner and penetrating between the underlying structures for considerable distances are dense bands of connective tissue which surround and serve to bring about atrophy of the glandular and muscular elements, and, finally, to replace them. At the same time the nerve trunks show atrophic and sclerotic changes and the walls of the vessels are thickened and their lumina partially occluded. Between the scattered fibroid areas the intermuscular tissues are invaded by fat cells and the individual muscle fibers are diminished in size and markedly degenerate.

In a second variety of atrophy the base of the tongue presents numbers of isolated scars which are retracted and produce smooth, indurated depressions in the surface of the organ. Between the



FIG. 4.—High power photomicrograph of the tongue in smooth (or indurative) atrophy of the base, showing subepithelial fibrosis and connective tissue replacement of the lymphoid follicles and mucous glands. (Photomicrograph by Dr. H. S. Martland.)

retracted areas atrophic lymphoid follicles are usually discernible by the naked eye. The substance of the tongue is firm and upon transverse section dense, streak-like, or pyramidal bands of smooth, pale tissue may be seen radiating downward and passing into the deeper parts for varying distances.

Microscopic examination in such cases reveals the same histological changes as in the form previously described, except that the connective tissue radiations are more irregular in distribution, thus accounting for the scarred condition of the surface of the tongue. The fibrous bands which are destined to replace the normal tissues are derived from the submucosa, and do not originate from localized fibrotic areas in the muscle substance, as one would naturally expect were the process dependent upon the healing of gummas at their point of predilection.

As the result of a systematic study of the base of the tongue in a large number of cases of smooth atrophy it appears to me that one is justified in the opinion that there are at least two forms of the lesion to be differentiated by the unaided eye, while histological observations indicate that both result from a simple replacement fibrosis such as syphilis is wont to produce in many other tissues. In neither form does there seem to be anything in the histology of the process to indicate that the condition is the sequence of the healing of ulcerating superficial gummas or of gummas located in the muscle tissue. Finally, it is not to be overlooked that in old age, especially, and in cachectic and anemic subjects, the base of the tongue often presents changes which, upon superficial examination, may simulate smooth atrophy very closely, in that the surface of the tongue is pale, relatively flattened, and smooth, the lymphoid structures being noticeably atrophied. But in these circumstances induration due to connective tissue replacement is lacking, a fact which serves at once to distinguish the specific from the simple atrophy.

In analyzing the records in 623 autopsies I found that the presence of acquired syphilis had been determined in 75 cases, the diagnosis having been based upon the occurrence of characteristic secondary lesions in the skin or mucous membranes, the presence of atrophic pigmented cutaneous scars, gummas in different localities, and interstitial visceral inflammations, especially in the liver in the condition known as *hepar lobatum*, and in chronic interstitial orchitis; upon syphilitic aortitis—a condition characterized by the presence of elevated, circumscribed, smooth or finely wrinkled, hyaline patches at the commencement of the aorta and decreasing as the vessel descends in its course, and usually unassociated with marked fatty changes or calcification; or upon various combinations of the above lesions, or upon parasyphilitic diseases, such as *tabes dorsalis*.

Of the 75 cases of syphilis thus encountered, smooth atrophy of the base of the tongue occurred 64 times (85 per cent.). In 55 instances atrophy was complete, and in 9 instances partial, in that it was associated with the presence of small numbers of atrophic lymphoid follicles, while in 9 cases the lymphoid follicles were hyperplastic and in 2 cases the base of the tongue appeared to be well preserved.

In the great majority of cases the base of the tongue was perfectly smooth or nearly so, scarring having been met with in a few instances only.

In 7 of the 75 cases of syphilis secondary lesions were present. In 3 instances these lesions were active, and in all of them the lymphoid follicles at the base of the tongue were hyperplastic, while in the remaining 4 the secondary lesions were well advanced in the process of healing. Of these latent secondary lesions, the

base of the tongue was moderately atrophied in 3 cases, while in the remaining case the lymphoid follicles were hyperplastic.

In 4 of the 75 cases parasyphilitic lesions were present, and of these the tongue was completely atrophied in 2. In the other 2 the lymphoid follicles at the base were enlarged.

In 64 of the 75 cases chronic syphilitic lesions were present, and of this number the base of the tongue was completely atrophied in 52 (81 per cent.), partially atrophied in 7 (10 per cent.), unchanged in 2 (3 per cent.), and in 3 (4 per cent.) the lymphoid follicles were hyperplastic.

It is of some interest in this connection to note that in 47, or 73 per cent., of the 64 cases of smooth atrophy of the tongue the spleen was markedly atrophied or degenerated, so that the lymphoid follicles were small in number and size or often totally invisible to the naked eye. Microscopic examination was made of the spleen in a considerable number of such cases, and the lymphoid follicles were invariably found to be small and poor in cells, while the walls of the vessels in the immediate vicinity were thickened and hyaline and their lumina partially or almost completely obliterated. Frequently the connective tissue was increased throughout. Whether this condition of chronic interstitial splenitis and atrophy of the lymphoid follicles is the expression of age and hence of the nature of a physiological process, or whether it is histogenetically comparable with the sclerosing changes in the tongue is difficult to say. It is interesting to note, however, that in 22 cases of syphilis the splenic follicles were distinctly hyperplastic, and that in 6 of them there was an associated hyperplasia of the lingual lymphoid tissues.

RESUME. Largely from what is known of the changes in syphilis in general, and partly from the observations set forth in the present communication, it may be stated safely, I think, that hyperplasia of the lymphoid tissues at the base of the tongue is not an infrequent phenomenon in the active secondary stage of the disease. It appears that these changes are often followed in course of time by atrophy of the lymphoid follicles and by connective tissue replacement, the latter process sooner or later advancing to include certain numbers of the mucous glands and muscle bundles in the deeper portions of the tongue, contraction eventuating in the condition known as smooth, or better, perhaps, as indurative atrophy.

There seems to be no histological evidence to support the view advanced by Lewin and Heller that smooth atrophy is the result of the healing of ulcerating gummas; the process is rather a simple replacement fibrosis, occurring most often in late acquired syphilis, it is true, but, nevertheless, quite independently of regional gummas. In this regard it presents much that is common to syphilitic changes as observed in other tissues.

In my experience it would appear that genuine indurative atrophy

of the base of the tongue is invariably the result of syphilis. This statement is based upon the systematic examination of the tongue in a considerable number of both syphilitic and non-syphilitic subjects, where I have yet to find a case of true indurative atrophy unassociated with definite anatomical signs of syphilis in some other part of the body.

On the other hand, however, there are numbers of cases of long-standing syphilis which present no evidence of atrophic, sclerosing lesions at the base of the tongue. In fact, the tongue in certain syphilitic individuals may be well preserved, or the lymphoid follicles may even be hyperplastic. Similarly, one often encounters simple smoothness and flatness of the base of the tongue in elderly, cachectic or anemic subjects, but the essential feature of smooth atrophy is lacking, namely, induration due to connective tissue overgrowth. This at once suggests that in approaching the diagnosis, both from the clinical and the anatomical standpoint, the finger should be trained to appreciate the degree of resistance offered by the base of the tongue and the sense of sight used only as an adjunct to that of touch. Failure to recognize the quality of induration in smooth atrophy is responsible, I believe, for much of the doubt that has been thrown upon the specific nature of the process, so that simple atrophic lesions, characterized by disappearance of the lymphoid follicles and partial replacement by fat, have been mistaken for genuine smooth atrophy.

At the same time, it is to be recalled that two types of true smooth atrophy are capable of differentiation by the naked eye—one diffuse and characterized by induration and smoothness, the other insular and associated with the formation of isolated scars. The former appears to be the more frequent type. Finally, it may be recorded that in the microscopic examination of a number of atrophic tongues removed from syphilitic subjects and stained for *Spirocheta pallida* by the older method of Levaditi the results were uniformly negative.

In closing, I wish to express my gratitude to Dr. Harrison S. Martland for the photomicrographs and to Dr. Charles E. Farr for the photograph of the base of the tongue.

THE SYNDROME OF SPHENOPALATINE-GANGLION NEUROSIS.

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THE sphenopalatine ganglion on its internal aspect lies, as a rule, close to the nasal mucous membrane, where it covers the sphenopalatine foramen. Lying in the pterygomaxillary fossa, it is in close

anatomical relation to the sphenoidal and post-ethmoidal sinuses above, with the maxillary sinus in front, and with the pterygoid process behind. Furthermore, as the pterygoid process is not infrequently hollowed out by a prolongation of the sphenoidal sinus downward, as far as the bifurcation of the plates (as well as into the great wing), the ganglion is often also in close relation to the sphenoidal sinus posteriorly. In view of its close proximity to the mucous membrane of the nose and to the several accessory sinuses, it is not surprising that the ganglion should be affected by inflammation in these cavities. In common with all sympathetic ganglia, it has a motor, a sensory, and a sympathetic root; some gustatory fibers seem also to pass through one of the roots. Remembering these complicated connections, it is also not surprising that the clinical manifestations arising from disturbances of this nerve centre should be multifiform.

In three papers I have already described some of these manifestations.¹ I have also remarked that, by reason of its intimate anatomical relations, the pterygomaxillary fossa may be regarded as tantamount to an accessory sinus of the nose, in so far as it may be affected by contiguity.

In this paper I should like, by assembling characteristic symptoms and signs, to formulate a syndrome, so far as I am able, of the manifold disturbances radiating from the sphenopalatine ganglion. In no single case have I seen all these signs and symptoms combined, although in every instance there have been definite indications pointing unmistakably to the ganglion as the centre of disturbance. My number of cases (60) is still small. Had a complete investigation been possible in all my cases the list might have been made much larger. My earlier observations were, however, directed primarily and mainly to the painful manifestations.

CLINICAL COURSE. I have pointed out² that in these cases, when seen from the beginning, the pains of post-ethmoidal or sphenoidal diseases have usually preceded the development of the characteristic neuralgic picture. I have also remarked that after the neuralgic manifestations have continued for some time (approximately four weeks) they begin to run irregularly, assuming the form of migraine, which may persist, even for years, after all local inflammatory conditions have disappeared.

NEURALGIC SYMPTOMS. One of the most striking manifestations of disturbance in the sphenopalatine ganglion is the wide and characteristic distribution of pain along definite lines. These neuralgic

¹ The Role of the Sphenopalatine (or Meckel's) Ganglion in Nasal Headaches, by Greenfield Sluder, M.D., *New York Med. Jour.*, May 23, 1908; The Anatomical and Clinical Relations of the Sphenopalatine (Meckel's) Ganglion to the Nose and Its Accessory Sinuses, by Greenfield Sluder, M.D., *New York Med. Jour.*, August 14, 1909; Further Clinical Observations on the Sphenopalatine Ganglion (Motor, Sensory, and Gustatory), by Greenfield Sluder, M.D., *New York Med. Jour.*, April 23, 1910.

² The Anatomical and Clinical Relations, etc., loc. cit.

manifestations are evoked by mechanical irritation of the ganglion, by the Faradic current, and by therapeutic injections of alcohol. The clinical picture, as developed in connection with inflammation originating in the neighborhood of the pterygomaxillary fossa, is also that of pain, often of great severity. This neuralgia is described as a pain at the root of the nose, sometimes also in and about the eye, taking in the upper jaw and teeth, sometimes also the lower jaw and teeth, and extending beneath the zygoma to the ear to take on the form of earache. It is emphasized at the mastoid, but is nearly always severest at a point about two inches posterior to the mastoid; thence, reaching backward, by way of the occiput and neck, it may extend to the shoulder-blade and shoulder, and, in severe attacks, to the axilla, arm, forearm, hand, and fingers. This is the most frequent picture, as I have observed it. Sometimes a patient complains also of a "stiff" or "aching" throat, without inflammation; of pain, or oftener, of itching, in the roof of the mouth; or of a pain inside the nose, which was once described to me as "neuralgia, or at least were it not inside of my nose, I would call it neuralgia." Occasionally, the teeth have been said to be "sore" or "too long."

SENSORY SIGNS. In contradistinction to these painful symptoms, I have observed, on the affected side, an accompanying slight anesthesia of the soft palate, and of the pharynx as far down as the lower part of the tonsil. This anesthesia may be detected also in the anterior lower part of the nose. (These tests, made with a minute lock of loose cotton fibers, could not be applied further back in the nose.)

MOTOR SIGNS. In a very large percentage of my cases the neuralgia has been accompanied by motor disturbance affecting the configuration of the soft palate. The palatine arch on the affected side is often, but not always, higher than on the well side. The uvula is often deflected from the affected side. In the movement of the soft palate upward and backward, in the physiological act of closing off the throat from the nose, the median raphé is deflected, from the affected side. The dimple which forms just above the uvula during this act is displaced, to the well side—normally, it is in the median line.

GUSTATORY CHANGES. Tests made with minute droplets of solutions of sugar, citric acid, common salt, and bisulphate of quinine, applied simultaneously on both sides of the dorsum of the tongue in its middle third, have shown in almost every case a diminished and delayed perception of taste on the affected side. As a rule, this holds true for the four solutions alike, but occasionally the rule is broken, when perhaps three may be perceived more quickly and better on the well side, and one may be perceived better and more quickly on the affected side. Three patients, either just before or during an attack of migraine, have shown a perverted sense of taste

—described by two as “metallic,” by the other as “a peculiar acid.” Four cases were accompanied by salivation, described by two patients as on the affected side. Three cases were accompanied by great sneezing, with profuse serous secretion, resembling that seen in rhinitis nervosa.

TREATMENT. The neuralgic symptom-complex can generally be relieved by the application of cocaine to the nasal mucous membrane covering the sphenopalatine foramen. In some cases relief follows a single application of a drop of a 20 per cent. solution. In other cases it may be necessary to make as many as three applications of a saturated (67 per cent.) solution (one drop on each applicator), each soaked for ten minutes into the tissues. In some recent cases of moderate severity this treatment is curative—that is, the application of cocaine stops the pain, and it does not come back.

In moderate to severe cases of longer duration—that is, up to nine months—injections of alcohol into the ganglion have proved curative; as many as three injections have been found necessary in most cases.

Even in the severest chronic cases cocaine affords temporary relief at the time of an exacerbation, the pain usually returning after an hour, but in diminished severity. The relief following the injection of alcohol into the ganglion often persists for months, but as the latent neuralgia may be rekindled at any time by an attack of coryza, the cure cannot be regarded as definitive.

Throughout my observation of these cases the question has often arisen whether the cocainizing of the ganglion itself was necessary, or whether an application to any point in the nose might not also give the same result; also, whether the relief was not, in part at least, referable to the exhilarant toxic effect of cocaine.

To remove any doubt on these points I have frequently cocaineized other areas in the nose to an extent sufficient to get pronounced general intoxication. When this test was made on a subject who had never before been treated as a nose patient (that is, who, although only too familiar with the neuralgia, had never been examined by a rhinologist), the result was uniformly negative. But when the application was made at the site of the sphenopalatine foramen, the relief was complete, or nearly so, according to the severity of the pain and the quantity of cocaine soaked into the tissues. This has also been the story in the case of patients whose noses had been repeatedly cocaineized in the treatment of sphenoidal and post-ethmoidal inflammations, but who had only recently developed sphenopalatine neuralgia. When other areas were cocaineized, the result was negative; when the sphenopalatine area was cocaineized the pain stopped.

In some of these neuralgias of greater intensity this relief when first experienced is almost startling. The impression produced upon the patient is so profound that it usually leaves him open to

suggestion, at least on the part of his physician. Later, when another attack begins, he promptly seeks relief in fullest confidence that it will be obtained. In a mild recurrent attack, cocainization of almost any part of the nasal mucous membrane may afford relief, but in such cases I have also tried normal saline solution with equal apparent benefit; in a severe attack, I have not been able to stop the pain except by cocainizing the ganglion area.

I herewith submit some notes of cases, each illustrative in its way:

CASE I.—Miss S., aged twenty-seven years, consulted me June 13, 1906. For many years, "off and on," she had suffered from pain in the head, which she described as paroxysmal, beginning at the root of the nose, involving the upper jaw and teeth (occasionally also the lower jaw and teeth), extending backward to the tip of the mastoid, and intensest about 5 cm. posterior to this point. These paroxysms recurred sometimes two or three times a week, and when at her best, at intervals of two or three months. Examination of the nose was negative in every particular. She made the observation, however, during an attack, that the spraying of the nose with cocaine, in a 4 per cent. solution, had relieved her of much of her pain.

In the absence of a definite diagnosis, but continuing the spraying of the nose with cocaine, it was found that each application appreciably mitigated the pain. Under this treatment, in apparently much improved condition, she passed from observation. About three months later she returned for treatment of a severe coryza, which in two days localized itself in a suppurating inflammation of the postethmoidal and sphenoidal sinuses of both sides. Almost simultaneously the old pain reappeared on the left side, involving the root of the nose, the cheek, the mastoid tip and a little behind it, the neck, shoulder-blade, shoulder, and arm—all in great severity.

Remembering the position of Meckel's ganglion, in close proximity to these sinuses, and the wide distribution of its branches and connections, it occurred to me that this distribution of pain might be due to the inflammation or its products, extending to or acting upon the ganglion; and, if this was true, that cocaine applied (soaked) over the sphenopalatine foramen might probably prove effective in at least mitigating its severity. The experiment was tried, and succeeded even beyond expectation. Since then I have applied the cocaine at the same site in severe recurrent attacks probably twenty times, always relieving the pain and usually aborting the attack.

I have also done some experimenting in these cases, but particularly in this case. During an attack an application of a single drop of 4 per cent. solution of cocaine to the nose in the area overlying the ganglion was followed by only the faintest relief. This dilute solution was then replaced by a drop of a 10 per cent. solution, with

greater relief. A drop of a 20 per cent. solution was then applied, with further lessening of the pain. A drop of a saturated solution (about 67 per cent.) was then applied, when the relief would usually become complete. Applications to other areas gave negative results. In very severe attacks the pain would stop, except at a point 5 cm. posterior to the tip of the mastoid, where, although greatly mitigated, it never quite disappeared, a very slight pain always persisting at this site. The applications were allowed to remain twenty minutes in position.

This patient suffered greatly from repeated attacks until December 1, 1908, when I began injections of alcohol, making the attempt to put the alcohol into or in direct contact with the ganglion. A straight needle directed upward and outward under the posterior fourth of the middle turbinate will reach the sphenopalatine fossa, just where the ganglion lies. The needle must, however, be passed obliquely through the lateral wall of the nose, which in this case was so hard as to make the procedure impossible. I thereupon drilled through the bone, thus removing the obstacle to the passage of the needle into the pterygomaxillary fossa and opening an easy route for subsequent injections. The injection of the alcohol aggravated the characteristic pain already described, but the exacerbatation was transitory and was followed by relief.

After a course of ten injections the relief seemed complete; but, after somewhat more than three weeks of freedom from pain, the patient contracted another severe coryza, with suppurative inflammation of the postethmoidal and sphenoidal cells on both sides, rekindling the old pain, now for the first time appearing also on the right side, although with less severity than on the left side. One application of saturated cocaine solution, posterior to and slightly above the posterior tip of the right middle turbinate, stopped the pain, and it did not recur. On the left side, relief was more tardy.

Miss S. had recently another "explosion," which was greatly relieved by one drop of saturated cocaine solution applied to the ganglion area, but a rather severe pain still persisted in the shoulder-blade on the same side. The next day the cocaine application was repeated, with complete relief of the pain.

The history of this case, to March 2, 1909, was reported by me last year.³ Since then she has been better and worse. Four more injections of alcohol have been administered. One in particular, on July 8, 1909, caused most violent pain throughout the entire area of distribution, as above described. Two days later she said that this injection had given the most relief of any. On October 25 she again appeared, suffering from an attack of coryza, with postethmoidal and sphenoidal suppuration on both sides; two days later she developed an intense characteristic neuralgia extending

³ Anatomical and Clinical Relations, etc., loc. cit.

down to the tips of the fingers. In this attack the pain also ran down the back and into the legs and feet. November 26 I again injected alcohol into the ganglion. While the needle was still in position I connected it to one of the electrodes of a Faradic coil, and had her hold the other in her other hand. Despite the profound cocainization, this electrical excitation evoked a painful reaction along the lines of the neuralgic distribution.

About this time I made a series of critical observations of the motor, sensory, and gustatory complications. The arch of the soft palate had always been and still remained markedly higher on the left side. The uvula was deflected to the right. The soft palate, and the pharynx down to the level of the lower part of the tonsil, were somewhat less sensitive on the left side to contact with a lock of loose cotton. There was also slight anesthesia at the floor of the left nostril anteriorly. In the middle and anterior third of the tongue the sense of taste for sugar, sodium chloride, citric acid, and quinine bisulphate was less acute on the left side than on the right.

Two intense exacerbations, in the winter of 1909-10, decided me to attempt the removal of the sphenopalatine ganglion. February 7, 1910, having elected to operate first on the right side, I removed the middle turbinate in order to afford free access to the area over the pterygomaxillary fossa. She stood this preliminary operation remarkably well in every way. March 15, 1910, under cocaine, I tore out the lateral wall of the nose anterior to and above and below the sphenopalatine foramen, and, with a side-biting forceps, removed a mass of soft tissue of the size of a large pea. I also opened the postethmoidal and sphenoidal sinuses. She stood the operation well. It was nearly painless. Three hours later she began to vomit, the vomiting continuing for four days. For the next three weeks she complained of persistent nausea.

The day after this operation I tested her sense of taste and found it better on the left side (middle third of tongue) than on the right. Prior to the operation it had been less acute on the left side. Sensation was also better on the left side than on the right. Previously it had been less acute on the left side. The arches of the palate were nearly symmetrical, although the left remained somewhat higher than the right. The characteristic deflection of the raphé with displacement of the dimple above the uvula, to the right side, was still manifest.

Six days after the operation she developed an acute sore throat, with a temperature of 103° F. The inflammation spread upward and infected the wound, rekindling the old neuralgia in great severity. This intercurrent neuralgia passed off in the course of the next two weeks, and there has been no return of pain⁴ on the

⁴ June 17, 1910.

operated (right) side. On the left side there has been no change from previous conditions.

Examination by Dr. C. M. Byrnes, of Baltimore, of the specimen removed from the pterygomaxillary fossa showed no ganglion tissue.

CASE II.—Mrs. G. C., aged sixty-seven years, consulted me December 14, 1908, for what she described as "a peculiar sort of a cold," of one week's standing. Besides a slight neuralgia in the upper jaw and occiput, she complained of a harassing itching of the palate, and of sneezing, with watery secretion, which began in the early morning and ceased by noon. In the afternoon and evening she was free of all symptoms except the neuralgia. Examination showed the area of the right sphenopalatine foramen markedly redder than the left. Six applications of 0.5 per cent. formaldehyde solution, made in the course of ten days, restored this congested area to a normal appearance, with cessation of all the symptoms. There has been no recurrence.

CASE III.—Mrs. W. S., aged thirty-eight years, and highly neurotic, consulted me February 20, 1907, for acute lingual tonsillitis, from which she recovered in a few days. She had no other nose or throat trouble. I did not see her again until October 1, 1909, when she returned complaining of pain inside her left nostril. Examination of the nose was in every way negative. She said she had not had a coryza, and had not had anything wrong in her nose until this pain began two days before. The pain continued in spite of local applications for three weeks, when it culminated in an explosive neuralgia, extending on the left side to the tips of the fingers and down the left leg. Despite liberal doses of phenacetin and codeine, taken on her own initiative, the pain of this attack surpassed everything that is usually accepted as the limit of physical suffering.

Examination of the nose during this attack was still negative. Because of the distribution of the pain in the maxilla, ear, mastoid, occiput, neck, shoulder-blade, shoulder, arm, forearm, hand, and fingers, I felt that it must proceed from the sphenopalatine ganglion. A first attempt to cocaineize the ganglion was unsuccessful, owing to a slipping of the cotton carrying the solution (67 per cent.) away from the site of the sphenopalatine foramen. Although it was soaked into the tissues for fifteen minutes, the cocaine did not relieve the pain. A second application, made at the site of the sphenopalatine foramen, was followed by some relief, and two more applications, made at the same site, stopped all the pain, including that which extended down the leg. After twenty minutes of complete relief, the pain began to return, but it remained very much less severe and was now controllable by phenacetin and codeine. She was well again in five days. She had previously had attacks of pain in different parts of her body, but never "anything of this kind."

Her palate arches had been symmetrical until the occurrence of the explosive attack. The day after the "explosion" the left arch

was found to be much higher than the right, and it remained so for approximately two weeks, when they became even. There was also slight anesthesia of the left side of the soft palate, pharynx, and anterior lower part of nose; no gustatory observations were made.

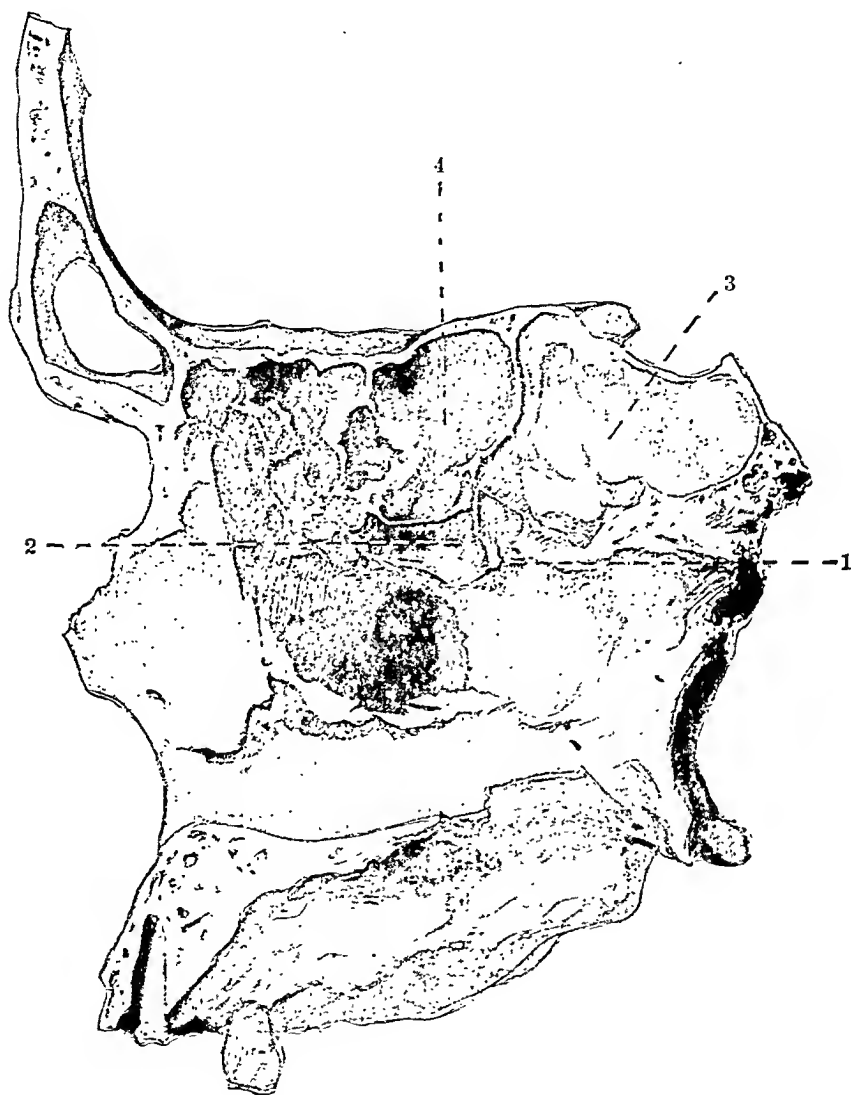


FIG. 1.—A specimen in which the pterygomaxillary fossa is bounded anteriorly by a thin plate of bone separating it from a postethmoidal cell.

CASE IV.—Mrs. L. E. S., aged thirty-eight years, consulted me March 31, 1909, for pain behind the right eye. Her nose showed a postethmoidal suppuration on that side. It rapidly yielded to treatment without operation—the suppuration and pain stopped. During the summer she contracted a coryza, probably reinfecting

the postethmoid. A little later, neuralgia, recognized from her description as of the sphenopalatine type, set in on the right side. She consulted me the second time February 28, 1910. At that time she had no sinus involvement, but showed three large veins over the sphenopalatine foramen, with redness and slight swelling of the mucous membrane. She complained of a return of the neuralgia, and of much sneezing, with profuse serous secretion, in the early

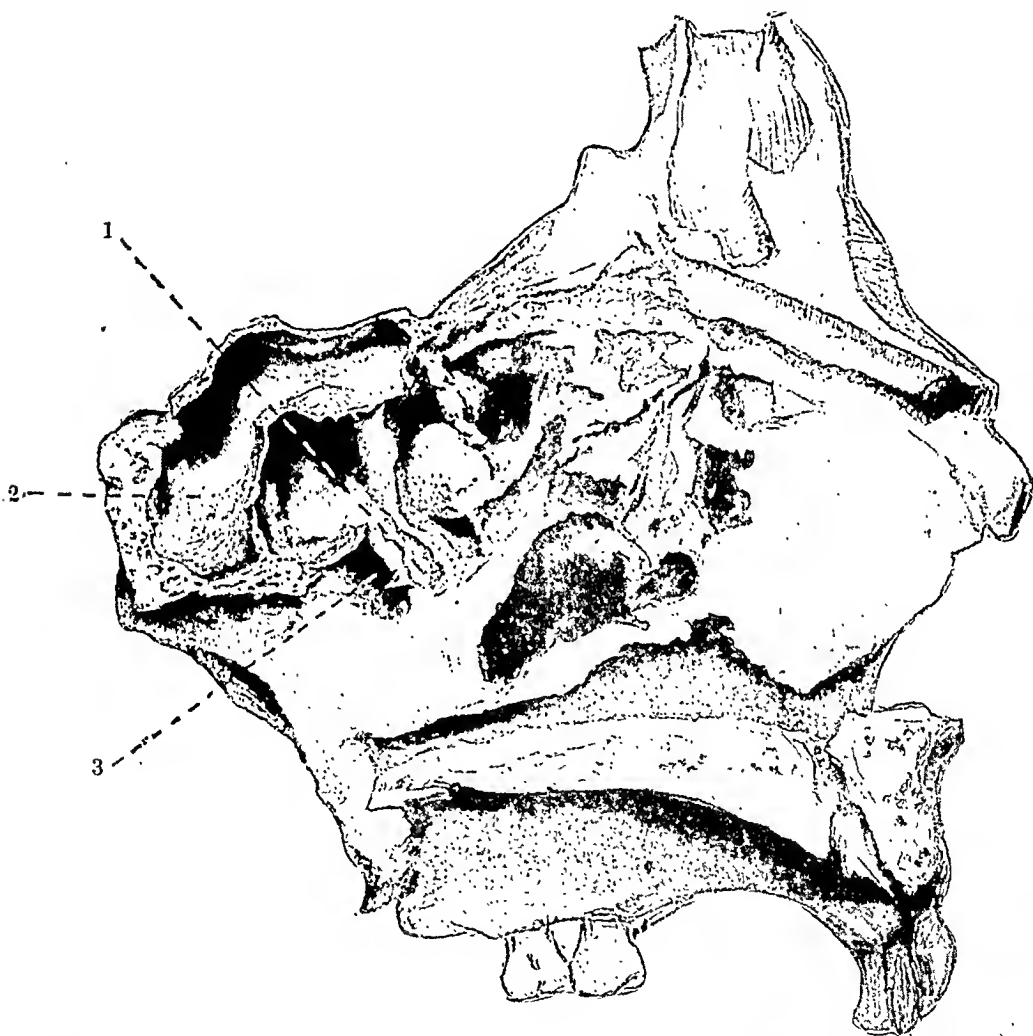


FIG. 2.—A specimen in which the pterygomaxillary fossa is bounded anteriorly by a thin plate of bone separating it from a prolongation of the sphenoidal sinus downward into the bony posterior wall at the apex of the maxillary sinus.

morning. She thought the sneezing started in the right nostril. Her sense of taste was the same on both sides for sugar and salt, but was better for acid and bitter substances (quinine) on the right than on the left side. The right palate arch was higher than the left. The anterior part of the nose and of the soft palate showed slight anesthesia (to cotton fibers) on the right side. A few appli-

cations of 0.5 per cent. formaldehyde sufficed to restore the area of the sphenopalatine foramen to an apparently normal condition, with cessation of the pain and sneezing. The motor, sensory, and gustatory reactions remain unchanged.

In ten cases of glaucoma the ocular pain has been controllable by the application of cocaine to the sphenopalatine foramen.

Two new drawings, representing particular anatomical relations, which I have not hitherto shown, are appended.

THE CLINICAL VALUE OF THE CAMMIDGE REACTION.

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(From the Pathological Laboratory of the German Hospital of Philadelphia.)

THE urinary examinations originally proposed by Cammidge¹ for the diagnosis of diseases of the pancreas have been performed repeatedly in the laboratory of the German Hospital, but they have proved to be unsatisfactory. Neither the "A" nor the "B" reactions could be depended upon as indicative of disease of the pancreas, and they were both soon discarded as useless. Because of this the new "C" reaction of Cammidge² was slow to find acceptance, although it was accompanied by a report of 250 cases in which no case of pancreatitis failed to give a positive result. It was not until the winter of 1908 that requests began to come to the laboratory for the "C" reaction. But when the value of the new technique was confirmed by reports from other laboratories,³ the hope was again entertained that an examination of the urine would yield valuable information concerning the condition of the pancreas. Since January, 1909, the Cammidge reaction has become a routine examination, and has been ordered as systematically as blood and stool examinations in all cases of suspected pancreatitis and in obscure conditions in the upper abdomen.

It has been frequently stated that the Cammidge reaction is an elaborate test that can only give reliable results in the hands of an experienced chemist. The technique is long. It requires usually more than an hour to carry out, and the end reaction must be allowed twenty-four hours for crystallization before it can be reported.

¹ Lancet, March 19, 1904.

² Robson and Cammidge, *The Pancreas: Its Surgery and Pathology*, 1907, p. 253.

³ Goodman, *Annals of Surgery*, February, 1909, p. 183.

But the test is neither elaborate nor difficult. The process consists in boiling a specimen of urine with hydrochloric acid, precipitation with various reagents, repeated filtration, and finally crystallization with phenylhydrazine hydrochloride. The directions given by Cammidge are explicit and are easily carried out. If they are followed accurately, there can arise only three possible sources of error: (1) From the presence of sugar in the urine; (2) from failure to obtain a clear filtrate before passing from one step to the next; and (3) from the difficulty in interpreting a crystalline end-product. The presence of sugar can be definitely determined by the ordinary phenylhydrazine test with the fresh specimen of urine. In every step a clear filtrate can be obtained by repeated filtration, but if there is considerable difficulty the filtrate can be cleared by passing through animal charcoal. In order for the reaction to be reported positive the final precipitate must contain the crystals described by Cammidge, but strict adherence to this description will settle the question of positive or negative result in every case. There are no delicate quantitative reactions or intricate problems requiring the judgment of an expert. Any physician with the laboratory training in inorganic, organic, and physiological chemistry required in medical colleges today can perform the reaction and obtain dependable results, if provided with necessary chemicals and apparatus.

We have followed closely the technique of the "C" reaction as proposed by Cammidge, and the result has been interpreted strictly in accord with his description of positive crystals. "Under the microscope the precipitate is seen to consist of long, light-yellow, flexible, hair-like crystals arranged in delicate sheaves, which when irrigated with 33 per cent. sulphuric acid melt away and disappear in ten to fifteen seconds after the acid first touches them." We have frequently found atypical crystals, and often those described as α -crystals by Swan and Gilbride.⁴ But these did not conform to the description of "long, flexible, and hair-like," and in practically every case they were not readily dissolved by 33 per cent. sulphuric acid. Only those cases in this series that presented typical Cammidge crystals in the phenylhydrazine precipitate are reported as positive.

From January, 1909, to April, 1910, the reaction has been studied in 154 cases, in all of which abdominal symptoms have made it desirable to determine the condition of the pancreas; 34 cases gave a positive reaction.

The negative cases have been arranged in Tables A and B, note being made in each case whether the patient was operated upon or not, and the condition of the pancreas when it was recorded in

⁴ New York Med. Jour., April 16, 1910, p. 283.

the history. Those cases in which the upper abdomen was not explored are considered as not operated upon.

TABLE A.—Cases with a Negative Cammidge Reaction; the Pancreas Presumably Normal.

	Total.	Normal Condi- to palpation.	tion not noted.	Not operated upon.
1. Cholelithiasis	47	8	28	11
2. Chronic cholecystitis and pericholecystitis	13	6	7	
3. Empyema of gall-bladder	5	1	4	
4. Adhesions upper abdomen	3	1	2	
5. Stricture of common duct (injured at former operation).	1	..	1	
6. Carcinoma liver and gall-bladder	4	1	1	2
7. Carcinoma gall-bladder and lesser omen- tum.	2	..	2	
8. Carcinoma stomach	1	..	1	
9. Ulcer duodenum	5	1	3	1
10. Echinococcus cyst liver	1	..	1	
11. Chronic appendicitis	7	2	4	1
12. Acute appendicitis	3	..	1	2
13. Cirrhosis liver, atrophic	2	..	..	2
14. Cirrhosis liver, hypertrophic	1	..	..	1
15. Retroperitoneal sarcoma	1	..	..	1
16. Diabetes	1	..	..	1
17. Catarrhal jaundice	2	..	..	2
18. Carcinoma uteri	1	..	..	1
19. Nephritis	1	..	..	1
20. Gastric neurosis	1	..	..	1
21. Aneurysm abdominal aorta	1	..	..	1
22. Goitre	1	..	..	1
23. Acute cholecystitis	1	..	..	1
	<hr/> 105	<hr/> 20	<hr/> 55	<hr/> 30

TABLE B.—Cases of Pancreatic Disease; the Cammidge Reaction Negative

	Total.	Confirmed.	Not operated upon.
1. Chronic pancreatitis	11	11	
2. Acute pancreatitis	1	..	1
3. Carcinoma pancreas	2	1	1
4. Cyst pancreas	1	1	
	<hr/> 15	<hr/> 13	<hr/> 2

In 105 cases with a negative Cammidge reaction there was no evidence of disease of the pancreas; 75 of these cases came to operation at which the gall-bladder region was explored, and in them palpation of the common duct made it necessary for the operator to feel the consistency of the pancreas. In these cases the pancreas was recorded as normal to palpation in 20 cases, but in the remaining 55 no note was made as to its condition; 30 non-operated cases were not considered from clinical examination to have pancreatic disease.

A lesion of the pancreas was diagnosticated in 15 cases that gave negative findings; 11 cases of chronic interstitial pancreatitis were

found at operation in which the pancreas was stated to have been abnormally enlarged, firm, or nodular; 2 cases of carcinoma of the pancreas (1 confirmed at postmortem examination) and 1 case of acute pancreatitis failed to give positive "C" crystals. The single case of cyst of the pancreas gave a negative reaction before operation, but twenty-one days after, while the rubber tube drainage was still in place, the reaction was decidedly positive.

TABLE C.—Cases Giving a Positive Cambridge Reaction.

No.	Diagnosis.	Operative findings.
1.	4. Chronic pancreatitis . .	Pancreas slightly hard and nodular.
2.	9. Chronic pancreatitis.	.
3.	13. Chronic cholecystitis.	
4.	16. Neurasthenia.	
5.	23. Chronic pancreatitis.	
6.	25. Chronic cholecystitis . .	Also adhesions. Pancreas normal.
7.	26. Catarrhal jaundice and nephritis.	
8.	31. Cholelithiasis.	
9.	32. Acute cholecystitis.	
10.	33. Cholelithiasis	Stones in gall-bladder, common duct, and ampulla of Vater. Pancreas normal.
11.	34. Cholelithiasis.	
12.	38. Chronic pancreatitis . .	Stones in gall-bladder and common duct. Adhesions. Head of pancreas enlarged and nodular.
13.	42. Diabetes.	
14.	48. Epigastric distress (not diagnosticated).	
15.	59. Ulcer duodenum.	
16.	76. Carcinoma stomach.	
17.	85. Chronic pancreatitis . .	Stones in gall-bladder and common duct; 2 stones in ampulla of Vater. Pancreas enlarged, firm, and nodular.
18.	87. Chronic pancreatitis . .	Adhesions. Pancreas somewhat hard and slightly thickened.
19.	91. Subhepatic abscess . . .	Gangrene and perforation of neck of gall-bladder. No note of ducts or pancreas.
20.	92. Caries of twelfth dorsal vertebra	Pancreas doubtfully firm (probably diseased).
21.	94. Cholelithiasis.	
22.	95. Carcinoma liver.	
23.	103. Chronic pancreatitis . .	Adhesions and ulcer of duodenum. Head of pancreas pronouncedly harder than normal.
25.	111. Acute exacerbation; chronic pancreatitis.	
26.	114. Acute exacerbation; chronic pancreatitis.	
27.	115. Empyema gall-bladder. .	Also inflamed omentum; no note of ducts or pancreas.
28.	121. Cholelithiasis	Stones in gall-bladder and 258 in common duct. Stone size hickory nut occluding ampulla of Vater and duct of pancreas. No note of pancreas.
29.	132. Acute exacerbation; chronic pancreatitis	Confirmed at postmortem examination.
30.	133. Abdominal adhesions . .	Adhesions around old hysterectomy wound; no note of pancreas.
31.	134. Carcinoma of stomach and pancreas.	
32.	139. Cholelithiasis.	
33.	144. Acute pancreatitis.	
34.	149. Chronic pancreatitis.	
	39. Pancreatic cyst	See Table B; positive after drainage.

In 34 cases the Cambridge reaction was positive (Table C). Of these, 14 cases came to operation and 1 to postmortem examination. The diagnosis of chronic pancreatitis was confirmed by palpation in 7 cases, and 1 case of acute exacerbation of a chronic pancreatitis was confirmed microscopically after death. In 2 cases the pancreas was normal to palpation, that is, 1 case of chronic cholecystitis and 1 case with a stone occluding the ampulla of Vater. No note was made of the condition of the pancreas in the 4 other unoperated cases—subhepatic abscess following perforation of the gall-bladder, cholelithiasis with 258 stones in the common duct, empyema of the gall-bladder, and abdominal adhesions.

Twenty cases with a positive reaction were not operated upon. In 7 cases a lesion of the pancreas was diagnosticated clinically as follows: 3 cases of chronic pancreatitis, 2 of acute exacerbation of a chronic pancreatitis, 1 of acute pancreatitis, and 1 of carcinoma of the stomach and pancreas. The remaining 13 cases were not considered to have pancreatic disease. They are as follows: Neurasthenia, catarrhal jaundice, 4 cases of cholelithiasis, chronic cholecystitis, acute cholecystitis, diabetes, epigastric distress (not diagnosticated), duodenal ulcer, carcinoma of the stomach, and carcinoma of the liver. Thus, in the 34 cases in which the Cambridge reaction was positive, a diagnosis of pancreatic disease was made in 15 cases, or 44 per cent.

Our cases of pancreatic disease are summarized in Table D. The positive reaction in 33 per cent. of cases with carcinoma of the pancreas agrees with Cambridge's report. But we have had cases of both acute and chronic pancreatitis in which the Cambridge reaction has been negative.

TABLE D.—Cases of Pancreatic Disease.

	Positive, Negative, Total.		
Acute pancreatitis (or acute exacerbation)	3	1	4
Chronic pancreatitis	11	11	22
Carcinoma of the pancreas	1	2	3
Cyst of the pancreas	0	1	1
	<hr/> 15	<hr/> 15	<hr/> 30

There were 43 cases in this series (Table E) which came to operation or postmortem examination, in which the condition of the pancreas was definitely recorded. The pancreas was found to be normal in 22 cases, 20 of which gave a negative, and 2 a positive Cambridge reaction; 18 cases of chronic interstitial pancreatitis gave 11 negative and 7 positive findings. The acute exacerbation of a chronic pancreatitis gave a positive reaction, while the cyst and carcinoma were negative.

TABLE E.—Cases Examined at Operation or Autopsy.

	Total.	Negative "C" reaction.	Positive "C" reaction.
Pancreas normal to palpation	22	20	2
Chronic interstitial pancreatitis	18	11	7
Acute exacerbation	1	0	1
Cyst of the pancreas	1	1	0
Carcinoma of the pancreas	1	1	0
	<hr/> 43	<hr/> 33	<hr/> 10

CONCLUSIONS. Our fifteen months of experience with the Cammidge "C" reaction in the German Hospital have led us to believe that it has a very limited value. A negative reaction does not indicate that the pancreas is normal, for negative results have been obtained in acute and chronic pancreatitis, carcinoma of, and cyst of the pancreas. Further, a positive reaction is not pathognomonic of pancreatic disease, as the reaction is found to be positive in some cases in which there is no evidence, even to direct palpation, that the pancreas is not normal. However, if history, physical examination, and examination of the feces point to the presence of a pancreatic lesion, we consider a positive Cammidge "C" reaction to be of value in completing the diagnosis. In other words, very little dependence can be put upon a negative reaction, and a positive reaction can only be considered of value as a confirmatory examination.

Most of the cases are from the service of Dr. John B. Deaver, surgeon-in-chief to the German Hospital, and I am indebted to him for access to the records. Also I wish to thank Dr. A. O. J. Kelly, chief of the Pathological and Bacteriological Department, for permission to make this report from the laboratory. The reactions have been performed by the resident physicians in their laboratory service, Dr. Kinard, Dr. Herman, Dr. Weber, Dr. Shoudy, and myself.

THE DETERMINATION OF CHLORINE AND THE PURIN BODIES IN URINE.

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It is well and widely known that the procedures at present in vogue for estimating the purin bodies (uric acid) in the urine are either (1) tiresomely tedious, or (2) woefully inaccurate. No apologies, therefore, are called for in submitting an original method which (a) saves much time, and (b) gives accurate results. The method given below for the determination of chlorine has obvious

advantages over those in general use. It is included in this paper mainly because the same solutions, practically, are required for the chlorides as for the purin bodies.

SOLUTIONS REQUIRED. 1. *Alkaline Starch Solution.* Mix 20 grams of corn starch with 250 c.c. of distilled water. To 750 c.c. of distilled water add 50 c.c. of 10 per cent. aqueous solution of sodium hydroxide and heat to boiling. Gradually add the starch mixture and allow to boil gently for five or ten minutes. Cool in running water.

2. *Sodium Nitrite Solution.* Dissolve 10 grams of the salt in 500 c.c. of distilled water.¹

3. *Magnesia Mixture.* Dissolve 100 grams each of magnesium sulphate and ammonium chloride in 800 c.c. of distilled water and add 100 c.c. of strong ammonia water.

4. *Decinormal Silver Nitrate.* Dissolve 16.88 grams of pure crystallized silver nitrate in about 800 c.c. of distilled water to which has been added 10 c.c. of chemically pure concentrated nitric acid. Make the volume up to one liter.

5. *Decinormal Potassium Iodide.* Dissolve 20 grams of potassium iodide and 2 or 3 grams of sodium hydroxide in about 1100 c.c. of distilled water.² This solution will require diluting after ascertaining its value by titrating against the silver solution.³ This solution will usually be sufficiently accurate for all clinical purposes if made by dissolving 16.6 grams of potassium iodide and 2 or 3 grams of NaOH in enough distilled water to make one liter.

DETERMINATION OF THE PURIN BODIES. To 100 c.c. of the urine add 10 c.c. each of the magnesia mixture, sodium nitrite solution, and strong ammonia water. Dilute about 1 c.c. of the alkaline starch solution with about 10 c.c. of distilled water and add 1 c.c. of chemically pure concentrated nitric acid.⁴ With a rubber bulb pipette place six or eight large drops, at intervals, on a piece of glass laid upon a sheet of white paper. From the

¹ I have not found it necessary to use the chemically pure sodium nitrite. The commercial salt usually contains traces of chloride, etc., but if the decinormal solutions are standardized in the presence of these impurities no error will be introduced by them in future work.

² The sodium hydroxide is added to prevent separation of free iodine on long standing.

³ The KI solution is standardized as follows: In a flask place 10 c.c. of the silver solution with 1 or 2 c.c. of chemically pure concentrated nitric acid and dilute to about 200 c.c. with distilled water. Add 5 c.c. each of the starch and sodium nitrite solutions. Now from the burette run in the KI solution until, after agitating, a permanent blue color remains. The reactions occurring are as follows. On adding the nitrite solutions nitrous acid is liberated. This decomposes the KI, and the free iodine, or a portion of it, combines with the starch to form the well-known blue iodide of starch, which in turn is immediately decomposed by the silver nitrate with precipitation of insoluble silver iodide. When all the silver has been precipitated the slightest excess of free iodine (KI) gives a permanent blue compound with the starch. The process should be repeated, and from the data obtained the KI solution may be diluted so that it will exactly correspond with the silver solution.

⁴ The acid should not be added to the starch solution until after it has been diluted with the water.

burette add the decinormal KI solution to the urine mixture until a drop of it when placed in contact with the starch indicator gives a decided blue color.⁵ When the reaction is obtained add to the urine mixture 7 c.c. of the decinormal silver solution and filter through a well-moistened paper. Filtration is fairly rapid and the filtrate comes through perfectly clear. Wash the precipitate with a small amount of distilled water to which a little ammonia has been added. To the filtrate and washings is then added the decinormal KI solution until a drop of the mixture, when brought in contact with a drop of the indicator, gives a faint blue color, showing that the excess of silver has all been precipitated as silver iodide. The number of c.c. of the KI solution added—ignoring that used in the first step—is deducted from 7 (the number of c.c. of the silver solution used), and the remainder multiplied by 0.0168. This gives the percentage of the purin bodies (as uric acid).⁶

DETERMINATION OF CHLORINE. To 5 c.c. of the urine contained in a small beaker add 1 or 2 c.c. of chemically pure concentrated nitric acid followed by 15 c.c. of the decinormal silver solution. Filter through a well-moistened paper. Filtration is rapid and the filtrate perfectly clear. Wash the precipitate with a few c.c. of distilled water. Dilute the filtrate and washings to about 200 c.c. with distilled water and add about 5 c.c. each of the alkaline starch and sodium nitrite solutions. Run in the KI solution from the burette until, after agitating, a permanent blue color remains. Should an excess of the KI solution be added inadvertently, an additional c.c. of the silver solution may be added and the titration continued more cautiously until the desired end reaction is obtained. Deduct the number of c.c. of the KI solution required from the number of c.c. of the silver solution used and multiply the remainder by 0.071 for the percentage of chlorine, or by 0.117 for the percentage of chlorine expressed as sodium chloride.⁷ I have used the method extensively during the last year or so and have found it exceedingly accurate. For the benefit of those who may have occasion to try it the following suggestions are offered:

⁵ It is convenient to use a rubber bulb pipette as a stirring rod. It will usually require from 0.3 to 0.4 c.c. of the KI solution to bring about the reaction.

⁶ A very satisfactory method for making this titration is to add the KI solution 1 c.c. at a time until the end reaction is obtained. Then add an additional c.c. of the silver solution. The KI solution can now be added more intelligently—knowing that less than 1 c.c. will be required. In this case the number of c.c. of the KI used must, of course, be deducted from 8.

⁷ This method for estimating chlorine has practically the same field of application as Volhard's, over which it is thought to have the advantage of a sharper, more delicate, definite, and easily recognized end-reaction. It is not interfered with by salts of lead, copper, zinc, cadmium, antimony, arsenic, bismuth, cobalt, nickel, chromium, manganese, magnesium, calcium, iron, etc. The only metallic salts that are known to interfere are those of mercury. These also interfere with the sulphocyanide method of Volhard.

1. The volume of fluid being titrated for excess of silver may range between 100 and 1000 c.c. It is preferable, however, that it be from 200 to 500 c.c.

2. The quantity of free nitric acid present may range from 0.25 to 5 per cent. Better results are obtained when the variation is from 0.5 to 1 per cent.

3. The quantity of silver to be precipitated should not, preferably, exceed 25 c.c. There is no reason why this condition should not always be present. Very large precipitates of silver iodide render the end-reaction less delicate; otherwise, the quantity of silver would probably have no effect on the accuracy of the results.

4. The amount of sodium nitrite present may vary from 0.1 to 0.2 gram. The former amount—5 c.c. of a 2 per cent. solution—is preferable.

5. The amount of the starch solution used—if not too old—is immaterial; 5 c.c. should suffice in all cases.

6. The indicator for chlorides may be prepared by mixing equal parts of the alkaline starch, and the sodium nitrite solutions. Of this, 10 c.c. is used for each titration. The mixed solutions will probably keep as well as when kept separately.

7. The alkaline starch solution to be used as indicator for chlorides will remain unaltered for about three months. After this time gradually occurring changes will introduce a slight error unless guarded against. If the decinormal solutions are standardized by using a freshly made starch solution, so that 10 c.c. of the one equals 10 c.c. of the other, it will be found after the starch solution has been kept for several months that 10 c.c. of the silver will require more, say 10.1 c.c. of the KI solution. This difficulty may be overcome (*a*) by using starch solutions not more than three or four months old, or (*b*) checking the KI solution against the silver solution every three months and noting the correct factor on the label. In this way the starch solution will give accurate results after keeping for longer than a year.

REVIEWS.

ANATOMY, DESCRIPTIVE AND APPLIED. By HENRY GRAY, F.R.S., Fellow of the Royal College of Surgeons; Lecturer on Anatomy at St. George's Hospital Medical School, London. Eighteenth edition. Thoroughly revised and reëdited, with additions, by EDWARD ANTHONY SPITZKA, M.D., Professor of General Anatomy in the Jefferson Medical College, Philadelphia. Pp. 1496; 1208 engravings. Philadelphia and New York: Lea & Febiger, 1910.

It is needless to say that any medical work which has passed through eighteen editions and has long survived the death of its author, owing not only to the intrinsic merit of his original work, but also to the able editors who from time to time have revised and reëdited it, must be a book of much value to the medical practitioner and to the medical student. This opinion is fully borne out by a careful examination of the present edition of *Gray's Anatomy*, the title of which has been changed from "Anatomy, Descriptive and Surgical" as in previous editions, to "Anatomy, Descriptive and Applied." This has permitted enlarging the scope of the work and allowing the editor to add much useful information by applying our anatomical knowledge to medicine as well as to surgery. And of this he has skillfully availed himself, thereby adding much to the practical usefulness of the book. Examples of such additions will, of course, be found in the sections on the pericardium, heart, pleura, and lungs, but they are by no means limited to these subjects, being found scattered throughout the work in the sections devoted to applied anatomy. A careful study of these sections will show that this edition contains under this caption all that is usually found in works devoted exclusively to applied anatomy.

The editor has rearranged much of the matter of the work, advantageously joining in the same section allied subjects which have hitherto been widely separated. Thus we find the description of the male and female perineum has been placed in the section devoted to the perineal muscles, and the article on hernia in the section devoted to the intestines, instead of appearing in the back of the book as has heretofore been the case with each of these subjects. Several paragraphs descriptive of the thorax have been

omitted from the section on the blood-vascular system and placed in that on the bones of the thorax; the description of the vertebral artery has been placed with the arteries of the brain, and receives only a mention and reference as a branch of the subclavian artery under the section on the arteries of the upper extremities; the chapter on the organs of voice and respiration now precede instead of following the organs of digestion, while to the latter chapter has been relegated the description of the tongue, only the description of the special gustatory organs being retained in the section devoted to the special senses, etc. Good judgment has been used in thus rearranging the subjects, which will add much to the practical value of the work as a text-book for students and a book of easy reference for the busy practitioner of medicine who wishes to refresh his memory of anatomical facts.

The various sections on embryology and on histology have been carefully revised and much new matter embodied in them.

We are glad to find that the editor has retained many of the old names for the various structures of the human body, placing the newer names in parenthesis, and this in spite of the fact that he was formerly an ardent advocate for the *Basle Nomina Anatomica* (BNA). This does not apply, however, to the chapters on the central nervous system, in which the newer nomenclature has been used as in previous editions.

The book is illustrated by 1208 engravings, an increase of 59 over the previous edition; this, however, does not represent the number of new plates, as several of the old figures have been replaced by new engravings.

Corrections have been made in a number of the illustrations, which make them correspond to the text; thus in the figure representing the posterior view of the bones of the forearm the attachments of the flexores longus et brevis pollicis are indicated by the modern and not by the obsolete names of these muscles as was the case in the previous edition. We are surprised, however, to find retained the illustration on page 450 (Fig. 342), entitled "A transverse section of the pelvis, showing the pelvic fascia from behind." A close examination of this figure will show that the criticism contained in a foot note in Heath's *Practical Anatomy* (page 279), the first American edition edited by W. W. Keen, M.D., and published by Henry C. Lea, 1870, is perfectly just. This figure was originally copied from Wilson's anatomy with acknowledgments, but was slightly modified by the addition of the vertebræ, drawn so as to make the view from the *front*, thus rendering the relation impossible. It is strange that this error should have escaped the eyes of so many able editors, one of whom for many years was Dr. W. W. Keen, himself.

Although the volume contains more matter than former editions, its size has been reduced by 118 pages, rendering it less bulky

than previous editions. This has been made possible by the judicious use of smaller type in the sections devoted to embryology, surface form, applied anatomy, etc., the larger type being used, as heretofore, for descriptive anatomy. It is needless to say that as a piece of "book-making" the work is fully up to the standard of former editions, in letter-press, paper, and binding.

Most of us were brought up on *Gray's Anatomy*, and it served us well in our infant days in medicine. It has been for more than half a century the standard in English by which other "Anatomies" have been judged and their merits determined; of unusual value when originally published, each succeeding edition has appeared to represent the virility of perennial youth invigorating a volume improving with age (like good wine). The latest edition is better than any that has gone before; the revision has been thorough; much new matter and many new points of view have been incorporated; a number of the older descriptions have been amplified and some abbreviated and simplified; and the rearrangement of the subject matter subserves a useful and practical purpose. There is no better anatomy; it is, indeed, doubtful if there is any quite so good in very many respects or one so generally useful to the student, the practitioner of medicine, or the surgeon; it is fully abreast of the times; and undoubtedly reflects the present state of anatomical knowledge.

H. M.

DISEASES OF THE GENITO-URINARY ORGANS. By E. L. KEYES, M.D., Clinical Professor of Genito-urinary Surgery in the New York Polyclinic. Pp. 975; 195 illustrations and 7 plates. New York: D. Appleton & Co., 1910.

THE author of this work congratulates himself with what seems undue emphasis upon having "thrown over," as regards the urinary organs, the "stilted procession" based on anatomy and taking up in order the urethra, the bladder, the ureters, the kidneys, etc., and dealing successively with their anomalies, their injuries, and their infections, and upon having adopted in place of this "a plan that attempts to lead the student from what might be termed the Principles of Urology to Gonorrhœa and Prostatism" and thence to other things, the section closing with neoplasms, injuries, anomalies, and "other minor topics."

This may be an improvement, and our incapacity to appreciate it may be due to ultra-conservatism; but we confess to a liking for the old way in which the "minor topics" were treated of first; and for example, the anatomy of the urethra and the use of urethral instruments were considered in direct connection with the diseases and injuries of the urethra and were not put among the "Principles

of Urology" and sandwiched between an article on clinical urinalysis and one on the technique of cystoscopy. Conceding, however, that the time-honored urinary anatomical arrangement may have been, as the author says, "utterly disrupted," it is surprising to find that the genital anatomical arrangement remains intact—and that diseases of the genital organs are treated "perforce in the anatomical order." As the author says he had also "perforce" to lean upon the *Handbuch für Urologie* and other authorities in preparing this book, he might have noted that most of them prefer and employ the anatomical arrangement. Perhaps they have not heard of its disruption. As a matter of fact, one of the most serious criticisms of a generally excellent work might be based on the scheme adopted by the author.

For examples, seven pages are devoted to the anatomy of the urethra in the so-called "Principles of Urology" (pp. 34 to 40), but if one looks in that section for the anatomy of the bladder, which surely might be thought to precede the "Technique of Cystoscopy," one looks in vain. The anatomy of the bladder will be found only on pp. 865-866, in connection with suprapubic operations; and even there, if one is interested in the "vesicle (*sic*) trigone" he is referred back to page 39, where that triangle is described, because on the dictum of Kalisher it is said to "belong to the urethra."

While we are fault-finding, we may note our disapproval of the mixture of the third and first persons and of the singular and plural, found throughout the book. When in the preface it is written "the author has perforce to lean," the next paragraph should not begin with "we gladly grant," or the next with "from my dear father." Many similar examples might be adduced, *e. g.*, on page 74, "I was once," and "I do not," are followed immediately by "our own observations."

In the main, however, the book is well written, interesting, and up to date. There is here and there a tendency to "fine" language which does not contribute to an impression of scientific accuracy. Not to mention the possible injustice to a worthy young man, to say that "Miss L., aged 18," who had a bad case of gonorrhœa, had been "betrayed by her lover," is to throw doubt, by implication, on the details in the further history of the case. So too, in enumerating the various theories advanced to account for hypertrophy of the prostate, the one known as White's is said to be based on a false prostat-uterine analogy and to have been "devised to defend the cause of castration as a remedy" (p. 285). The so-called "false" analogy was a comparison such as the author himself makes on the following page (286) when he says "the prostate tends to undergo retrograde changes with the cessation of its sexual function, as do the uterus and the female breast." The theory was an outcome of consideration given the general question, but was not "devised to defend" anything. The side-heading "Sexual Senility," is

ambiguous and misleading. The footnote referring to the original paper is inaccurate. Otherwise there is no exception to be taken to his statement.

There is nothing in the main body of the book that deserves unfavorable criticism, unless it is the retention, in relation to the mercurial treatment of syphilis, of the somewhat misleading term of "tonic" introduced in 1876 by Dr. Keyes the elder, and at that time a useful and appropriate adjective as aiding both the profession and the laity to overcome old-time prejudices. But that that excellent paper led to "the less and less important part in the routine treatment of syphilis" that "iodid" (*sic*) has since played is a *non-sequitur*. To omit iodine or the iodides altogether from the routine treatment, as the author does, for the reason that he cannot see "the precise reason" for their employment is to ignore a mass of clinical evidence of a similar, though, of course, less vital and convincing, character to that which leads us to the administration of mercury. If the "precision" lacking refers to the *modus operandi*, we are even yet about as much in the dark as to one drug as to the other. Calling the one a "tonic" doesn't clear up that darkness in the slightest.

The points of disagreement we have noted are, with the exception of the last, unimportant. With the general teachings throughout we are in hearty accord. We have found the book reliable and interesting, giving evidence of both wide reading and large experience. Although its field is already well covered in all languages it has an individuality of its own and seems to us likely to be a permanent and successful addition to the treatises on genito-urinary and allied diseases.

J. W. W.

PROGRESSIVE MEDICINE. A QUARTERLY DIGEST OF ADVANCES, DISCOVERIES, AND IMPROVEMENTS IN THE MEDICAL AND SURGICAL SCIENCES. Edited by HOBART AMORY HARE, M.D., Professor of Therapeutics and Materia Medica in the Jefferson Medical College; Assisted by LEIGHTON F. APPLEMAN, M.D., Instructor in Therapeutics in the Jefferson Medical College, Philadelphia. Vol. III, 1910; pp. 338; 36 illustrations. Philadelphia and New York: Lea & Febiger, 1910.

VOLUME III of *Progressive Medicine* for 1910 opens with an excellent discussion of diseases of the thorax and its viscera, including the heart, lungs, and bloodvessels, by William Ewart. It consists of 98 pages, and in it special mention is made of the streptothricosis and tuberculosis; lymphatic preliminary tuberculosis, particularly in children, and the pathway of tuberculous infection; the diagnosis and the treatment of pulmonary tuberculosis; the maintenance

of respiration by intratracheal insufflation; the normal auscultatory differences in the sides of the chest; spinal percussion in the diagnosis of diseases of the mediastinum; the genesis of hydrothorax from compression of the pulmonary veins; autoserotherapy in serous pleural effusion; the treatment of empyema; acute spasmodic asthma as evidence of autointoxication; emphysema; recurrent hemoptysis other than of tuberculosis or cardiac origin; orthodiagraphy; cardiac arrhythmias; angina pectoris; arteriosclerosis; aneurysm; and high blood pressure. William S. Gottheil has an interesting chapter on dermatology and syphilis, comprising 50 pages, in which special mention is made of auto-intoxication in diseases of the skin; the Bier hyperemic treatment in diseases of the skin; grain itch; external lead poisoning; leprosy; pellagra; eruptions of pregnancy; ringworm; sarcoma of the skin, and various manifestations of syphilis. Edward P. Davis devotes 132 pages to a valuable discussion of recent progress in obstetrics, calling special attention to the activity of the ovary during pregnancy; the diagnosis of the complications of pregnancy and their prevention; the toxemia of pregnancy; eclampsia neonatorum; abortion; labor and its complications; placenta prævia; the puerperal period; puerperal sepsis; obstetric surgery; and convulsions and other disorders in the newborn. The volume concludes with an interesting chapter on diseases of the nervous system by William G. Spiller; 57 pages are devoted especially to brain tumor; aphasia; abscess of the brain; hemiplegia; encephalitis; meningitis; tabes dorsalis; spinal tumor; poliomyelitis; fracture of the vertebræ; cervical rib; multiple neuritis; facial palsy; tic douloureux; and hysteria. As has been repeatedly said, these volumes are virtually a necessity to him who would keep abreast of the times. A. K.

PRÉCIS DU TRAITEMENT DES FRACTURES PAR LE MASSAGE ET LA MOBILISATION. By DR. JUST LUCAS-CHAMPIONNIÈRE, Honorary Surgeon to the Hôtel Dieu, of Paris; Member of the Academy of Medicine; President of the International Society of Surgery. Pp. 268. Paris: G. Steinheil, 1910.

LUCAS-CHAMPIONNIÈRE has written repeatedly on this subject, and his views have been expressed at length in a larger monograph. So convinced is he of the value of his methods, however, that he has prepared this abstract of his larger work, and confidently states that after its publication no one will have the right to plead ignorance of these methods, and no one can confound the "massage of fractures" with the comparatively brutal manœuvres of ordinary massage. It is on this latter account, we believe, a valuable addition

to surgical literature. The reader finds that, with few exceptions, this patriarchal French surgeon treats fractures with as much common sense as anyone else; that, while he is constantly decrying the "classical methods" of reduction and immobilization, he nevertheless admits that certain fractures must be reduced more or less accurately, and that so long as the fragments have a tendency to become displaced they must be supported by some kind of retentive appliance until this tendency has passed. Some fractures he makes no attempt to reduce—such as impacted fractures of the neck of the femur, of the upper end of the humerus, and of the lower end of the radius. He recognizes the impossibility of accurately reducing some fractures—some of both bones of the forearm, and some of the shaft of the femur—and he maintains with entire justice that perfect function is not always dependent upon accurate reduction.

The massage he employs is extremely gentle, often merely a caress with the finger tips, and never over the seat of the fracture itself, and never sufficient to cause the least pain. The mobilization is very limited in extent, and is applied only to the neighboring joints, not to the fracture itself. Active use of the limb is not encouraged at an outrageously early period.

The author's system of therapeutics is founded on the clinical observation that "a certain amount of motion of the fragments encourages the phenomena of bony repair;" and the only question at issue between him and other surgeons appears to be as to the amount of motion which is favorable. For our own part, we believe that immobilization should be as complete as is possible without constricting the soft parts; and that when this has been accomplished the unavoidable amount of motion which remains will prove quite sufficient; and that proper care of the skin at each dressing involves massage enough. And we hold that while excellent function often is secured after imperfectly reduced fractures of the shaft of long bones, yet in the neighborhood of joints (elbow, wrist, shoulder, and ankle, especially) satisfactory results can be expected only after as nearly perfect replacement of the fragments has been secured as in any way possible.

A. P. C. A.

EMERGENCIES OF GENERAL PRACTICE. By PERCY SARGENT, M.B., B.C., F.R.C.S., Surgeon to Out-Patients, St. Thomas' Hospital; and ALFRED E. RUSSELL, M.D., B.S., F.R.C.P., Physician to Out-Patients, St. Thomas' Hospital. Pp. 364; 91 illustrations. Oxford Medical Publications, London: Henry Frowde, and Hodder & Stoughton, 1910.

THIS is an excellent hand-book for use in the accident ward of large hospitals. It contains, in clear and concise language, simple

directions for both surgical and medical emergencies, such as hemorrhage, burns, fractures, acute infective diseases, foreign bodies in the respiratory, alimentary, and urinary tracts; affections of the heart and respiratory system; acute abdominal diseases; injuries of the nervous system, of the ear, and of the eye; and poisoning. The advice given is sound, with very few exceptions. Among the latter, we may mention the advice (page 228) to give cathartics to patients with peritonitis as soon after operation as they can swallow; and the recommendation (page 76) always to employ an anesthetic for reducing fractures of the elbow. It might have been well to suggest the use of sera, or of transfusion of blood, in cases of hemophilia; and intraneural injections of antitoxin in the treatment of tetanus. The authors commend the antitoxic action of anti-colon bacillus serum in cases of peritonitis. A. P. C. A.

HANDBUCH DER GESAMTEN MEDIZINISCHEN ANWENDUNGEN DER ELEKTRIZITÄT EINSCHLIESSLICH DER RÖNTGENLEHRE. In three parts. By PROF. DR. BORUTTAU, PROF. DR. L. MANN, PROF. DR. M. LEVY-DORN, and PROF. DR. P. KRAUSE. Part I; pp. 599; 317 illustrations. Leipzig: Werner Klinkhardt, 1909.

THIS work, when finished, is to be a comprehensive work on the uses of electricity in medicine, and is to be in three parts. The character of the editors and contributors is such that there is no doubt that it will be of the highest order. The first part contains the introductory chapters upon electricity and magnetism, the physiological chemistry of the influence of electricity on the human being, the theories of electrical irritation, electrical physiology and pathology, and a beginning description of the technique and apparatus. It is manifestly impossible to give a complete review of such work, because, as has been stated, this is only the beginning of what promises to be the greatest work on the medical uses of electricity to be published.

T. H. W.

LA TENSION ARTÉRIELLE EN CLINIQUE. SA MESURE. SA VALEUR SÉMÉIOLOGIQUE. Par le docteur LOUIS GALLAVARDIN, médecin des hopitaux de Lyon. Pp. 208; 70 illustrations. Paris: G. Steinheil, 1910.

THE importance of accurate instrumental measurement of the arterial tension as opposed to the old uncertain method of relying merely on the human tactile sense is now generally recognized.

In a book of nearly two hundred pages Gallavardin discusses the subject of blood pressure estimation mainly from the standpoint of technique and clinical utility. The first part of the book describes the various blood pressure instruments now on the market, comparing their various merits and disadvantages. The relations of the systolic and the diastolic pressures are systematically considered. For determining the former he prefers the Riva Rocci type of instrument, and for the latter, the procedure based on oscillatory variation, in which category he includes the auscultatory method. In the second part of the work the clinical value of blood pressure estimation and its variation under physiological and pathological conditions are discussed. To him who seeks information regarding the merits of the various blood pressure instruments and the method of their employment the book will prove entirely satisfactory. No attempt has been made to treat of the subject of human arterial tension in a detailed or exhaustive manner, and no reference is, therefore, made to such subjects as treatment or variations in individual diseases. The book is accurately and concisely written, liberally illustrated, unencumbered by needless verbiage, and deals in a satisfactory manner with the subject which its title implies.

G. W. N.

AN INDEX OF SYMPTOMS, WITH DIAGNOSTIC METHODS. BY RALPH WINNINGTON LEFTWICH, M.D., late Assistant Physician to the East London Children's Hospital. Fourth edition; 451 pages; 11 illustrations. New York: William Wood & Co., 1910.

THIS unusual little book contains a large amount of useful information arranged in a unique manner. The purpose of the author has evidently been to furnish an aid to diagnosis; to what extent, however, this object has been attained seems doubtful. The chief usefulness of the work would appear to be its value as a brief book of reference in the hands of one already somewhat skilled in diagnosis. The book consists of a series of headings embracing all possible subjective and objective symptoms and physical signs referable to the various portions of the body. Under each heading there is a list of the diseases and conditions in which the symptom or sign in question may occur. In addition, there is frequently an explanatory note or definition accompanying the more important headings. Given a patient presenting a certain symptom, one turns to the column headed by this symptom in order to discover its possible causes. The practical application of this method is shown by taking, for example, the symptom headache. After finding several lists dealing with localized headaches, one is confronted

by a list of no less than eighty conditions in which unclassified headache occurs. It is doubtful whether this formidable array of possibilities would greatly facilitate the task of the perplexed diagnostician. No one can look over the book without having to acknowledge the wonderful completeness of the lists of diseases. To be sure, here and there unexpected omissions do occur, as, for instance, under palpitation no mention is made of its occurring in organic heart lesion, obviously a cardinal cause for this symptom. Undeniably a great deal of careful conscientious labor has been expended in compiling this work. The question arises, however, as to whether the final result repays the effort, since it is doubtful whether books of this type really furnish the aid they are intended to give. On the other hand, that this book has reached its fourth edition would seem to indicate either that it has already proved of value to many, or that physicians are still eager to take advantage of any possible short cut that seems to offer a quick solution to the all-important problem of correct diagnosis. G. M. P.

CONSUMPTION: ITS PREVENTION AND HOME TREATMENT. BY H. HYSLOP THOMSON, M.D., Medical Superintendent of the Liverpool Sanatorium. Pp. 75. London: Henry Frowde; Hodder & Stoughton, 1910.

THIS handbook, which is based on a series of lectures delivered to the patients at the Liverpool Sanatorium, was prepared primarily for the enlightenment of the consumptive and his friends in open-air home treatment. The layman finds here a book well worth reading. Several tables are shown whereby the patient may determine the amount of exercise and the nature of the diet dependent upon the temperature, weight, etc. Although drugs are not considered, without the last chapter the book might stimulate self-treatment; however, the author shows here in an epitomized form the signals calling for the physician. Throughout the text one finds little, if any, matter for adverse criticism. Among a large number of books written for the edification of the consumptive, this is one of the best. W. T. C.

PROGRESS OF MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF
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The Method of Injecting "606."—WECHSELMANN and LANG (*Deut. med. Woch.*, 1910, xxxvi, 1395) have developed an improved technique for administering "606." The drug is rubbed in a sterile mortar with 1 to 2 c.c. of NaOH (10 per cent.). Acetic acid is now added drop by drop until a fine yellow precipitate appears. To this one adds 1 to 2 c.c. of sterile water and then 1 per cent. acetic acid or $\frac{N}{10}$ sodium hydrate (whichever is required) until the fluid is neutral to litmus paper. Pain following the injection is practically absent if the neutralization has been exact. The suspension is drawn into a syringe and is injected subcutaneously beneath the shoulder-blade, the skin having been disinfected. At times there is slight pain at the site of injection for a few minutes and on the second or third day a little local swelling may be noted. No rise in temperature or pain worth mentioning has been observed in 60 to 70 cases. The activity of the drug is in no way diminished. All apparatus and solutions must, of course, be sterile.

Hereditary Lues Cured by Treating the Mother with "606."—TAEGER (*Munch. med. Woch.*, 1910, lvii, 1725) reports the case of a syphilitic mother whose infant showed unmistakable evidence of lues eight days after birth, the child being apathetic, without appetite, and having pemphigoid vesicles on the soles of the feet and paronychia syphilitica of the right hand. At this time the mother was given 0.6 gm. of "606" with the usual result—prompt recovery. The astonishing feature was the change in the condition of the infant. For two days the lesions spread, but beginning with the third day after the mother's treatment, there was a rapid subsidence of symptoms, so that the skin lesions had disappeared on the fifth day. The child gained rapidly in strength

and weight and emptied the breasts at each feeding. Taege suspected that the arsenobenzal had been excreted in the milk. He analyzed 100 grams of the mother's milk but found no trace of arsenic. Professor Ehrlich was acquainted with the facts and offered this explanation: The sudden killing of the spirochetes in the mother liberated a large quantity of endotoxin. This led to the production of an antitoxin which was excreted in the milk and led to the remarkable improvement of the suckling. DUBOT (*Münch. med. Woch.*, 1910, lvii, 1825), without the knowledge of Taege's experience, reports a case which confirms and substantiates in every particular the observations of the latter. A mother, with advanced syphilitic ulcerations of the forehead and cheeks (treated with mercury and iodides), presented a child with the stigmas of lues—the skin red and wrinkled, the cry weak, anorexia, nasal catarrh, and several days after birth a papular eruption on the body with papules and pemphigoid vesicles on the soles of the feet. The baby gained only 100 grams in the first twenty-one days of life. The mother now received 0.5 gram of "606" in the right gluteal region and on the following day 0.45 gram in the left. On the third day after the mother's treatment, the skin eruption of the baby began to fade, the nasal catarrh was much lessened, and the baby took more nourishment. Within three weeks the child gained 1200 grams in weight and was healthy and normal in appearance except for a slight hydrocephalus which persisted. No arsenic could be found in the mother's milk. Professor Ehrlich gave to Dubot the explanation narrated in the preceding case. The child is to receive 0.008 to 0.01 gram of "606" per kilo of body weight.

The Wassermann Reaction after "606."—LANGE (*Berl. klin. Woch.*, 1910, xlvii, 1656) has followed the Wassermann reaction in 268 cases of lues treated with Ehrlich's "606" in Wechselsmann's clinic. Of these 153 became negative four to five weeks after treatment. The time required always depended on the original intensity of the reaction. Eighteen cases which were negative before treatment (one of malignant lues and one of tabes) remained so. There were 9 negative cases which had been treated with mercury and they remained negative after taking "606," and two primary cases which had not developed a positive Wassermann reaction. There remain 97 cases, of which 54 were positive after a maximal time of three weeks after treatment. Thirty-four showed definite decrease in intensity of reaction after a maximal period of five weeks. Eight patients died with positive reactions. In addition to lues, they had pernicious anemia, chronic nephritis, liver, and cardiac gummas, etc.

Mononuclear Leukocytes of Endothelial Origin.—PATELLA (*Deut. med. Woch.*, 1910, xxxvi, 1487) has sought to establish the endothelial origin of the large mononuclear cells of the blood. He also believes that the medium-sized and small mononuclears are derived from the large mononuclears. Normally, the cells result from desquamation of the endothelial cells of the bloodvessels, etc. In diseases in which endocarditis is met with, desquamation is more active and the mononuclears are increased, as in typhoid fever, for example.

The Resistance of Brazilian Malaria to Quinine.—NOCHT and WERNER (*Deut. med. Woch.*, 1910, xxxvi, 1557) have observed 96 cases of malaria contracted in Brazil. The 96 cases include relapses and were met with in 63 persons. The infections were with tertian and estivo-autumnal parasites. The results of their observations are in part as follows: The malarial infections from the interior of Brazil have shown a very marked resistance to quinine. Double the usual dose and more has proved insufficient to prevent relapses, which often occurred during the after-cure. Methylene blue was even less efficacious than quinine. The Ehrlich-Hata arsenical preparation "606" in 0.3 gram dose intramuscularly exhibited a manifest and prompt antiparasitic action, but a single dose did not effect a permanent cure. Observations with this preparation are still in progress. In many of the cases of tertian fever, the segmenting parasites were unusually small and there was relatively slight change in the erythrocytes (that is, swelling and Shüffner's granules).

A New Experiment in the Treatment of Cancer.—OESTREICH (*Berl. klin. Woch.*, 1910, xlvii, 1698) has noticed that cartilage and arterial walls are almost always spared from cancerous invasion. The hardness of cartilage cannot explain its apparent immunity, since bones are so frequently involved. He, therefore, assumed that immunity was to be explained on a chemical basis and has attempted to utilize this supposition in a therapeutic way. Since sodium chondroitin-sulphate is a constituent of cartilage and arterial wall and is harmless, it was decided to try the effect of subcutaneous injections of the substance in inoperable carcinoma of man. The initial dose is 0.1 gram daily, increased to twice daily. After a week the dose is doubled. The aqueous solution is sterilized in the waterbath and is injected subcutaneously in any part of the body. The treatment lasts four to six weeks. There is then an intermission of one to two weeks, when the same procedure is repeated. The observations have extended over one and a half years, and the results are rather suggestive. A local reaction in the tumor, with redness, swelling, and severe pain, is usual. Many cases have seemed to be arrested; some were improved and left the hospital. At times a moderate elevation of temperature and acceleration of the pulse were noted after the injection. In others, who died of the disease, non-ulcerative metastases showed infiltration with polymorphonuclear leukocytes and degeneration and necrosis of the cancer cells. Such findings led Oestreich to hope that the treatment may be extensively tried and especially in post-operative cases, in order that statistics may be accumulated to show whether recurrences are less frequent.

Propagation of Typhoid Fever by the Dog.—The difficulties of stamping out typhoid fever are increased by the discovery of a new form of chronic bacillus carrier. COURMOUNT and ROCHOUX (*Progrès méd.*, 1910, 389) have pointed out that dogs may be a great source of danger. By feeding fecal material from a typhoid-fever patient to dogs they have converted them into true bacillus carriers. Their stools contain typhoid bacilli which they could disseminate with ease. The authors consider it a very important determination from the point of view of public hygiene.

The Relation of Blood Platelets to Hemorrhagic Disease.—DUKE (*Jour. Amer. Med. Assoc.*, 1910, lv, 1185) describes the "bleeding time" of hemorrhages and a method for measuring the same. After a small cut in the lobe of the ear, the blood is blotted up on absorbent paper at half minute intervals. This gives a series of blots of gradually decreasing size, each blot representing one-half minute's outflow of blood. The total duration of such a hemorrhage is called the "bleeding time," the normal varying from one to three minutes. This bleeding time was found slightly delayed in severe anemia (five to ten minutes). But great delays were found in (1) cases in which the platelet count was excessively diminished (ten to ninety minutes), (2) cases in which the fibrinogen content of the blood was excessively reduced (ten minutes to twelve hours), and (3) experimental animals with both platelets and fibrinogen reduced. The bleeding time is independent of the coagulation time. For instance, the bleeding time was normal in several cases of jaundice with delayed coagulation time, two of which cases died of pathological hemorrhage. It was normal in patients with hemophilia who had a slight delay in coagulation time and a pathological hemorrhage. It is, therefore, of no value in determining the tendency to bleed in jaundice and hemophilia, and in the types of purpura hemorrhagica which have normal platelet counts. The author reports 3 cases of hemorrhagic disease with normal coagulation time but diminished platelet counts and delayed bleeding time. They all suffered such losses of blood that transfusions were performed. With each transfusion the platelets were increased, the bleeding time diminished, and the condition improved. One case showed improvement following a spontaneous increase in platelets. With the drop in platelets in these cases the bleeding time was again diminished and hemorrhages occurred.

Polyvisceral Scleroses.—PLAY and SÉZARY (*Bull. et mém. Soc. méd. hôp. de Paris*, 1910, xxvii, 143) report a case of unusual interest, an arteriosclerotic in whom they observed develop successively the syndromes of cardiorenal insufficiency, hepatic insufficiency, (Laennec's cirrhosis), and finally adrenal insufficiency (Addison's disease). The patient, aged sixty-one years, complained of dyspnoea and oedema. His heart was dilated, irregular, and showed all the signs of decompensation. There was a definite picture of Bright's disease. Under observation, ascites, icterus, a portal collateral circulation, and hemorrhoids developed with a gradual diminution in the liver volume. An alimentary glycosuria confirmed the diagnosis of a cirrhosis of the liver. He had not had malaria. Diagnostic tests for syphilis and tuberculosis were negative. He was a marked alcoholic. Under treatment the cardiorenal syndrome cleared up and disappeared. But the classical signs of Laennec's cirrhosis were established very rapidly. At the same time an adrenal insufficiency was revealed by a pigmentation of the skin and buccal mucous membranes, and an extreme asthenia. A simultaneous muscular atrophy occurred—distinguishing, according to the authors, a sclerotic adrenal from tuberculosis of the glands. The patient died in coma. The autopsy and histological study confirmed the successive diagnoses. The authors believe that alcohol was the etiological factor of this general sclerosis, involving the arteries, heart, kidneys, liver, and adrenals—the so-called polyvisceral scleroses.

Experimental Ulcers of the Stomach.—LOEPER (*Bull. et mém. Soc. med. d. hôp. de Paris*, 1910, xxvi, 31) has injected gastric juice into the circulation and later a salt solution extract of the gastric mucosa, in an attempt to provoke gastric hypersecretion and typical ulcerations. He obtained leukocytoses of 36,000 to 88,000, subsequent anemia, variations in arterial tension, emaciation, and diarrhoea. With injections of gastric juice in the rabbit an abundant hypersecretion occurred, with a very high acidity, and rapid digestion and evacuation of the stomach contents. The intravenous injection of an aqueous extract of macerated gastric mucosa in small doses caused a similar result, in large doses the mucosa at the fundus and pylorus was congested, and presented two small erosions reaching down to the submucosa. One of the animals died suddenly and was found to have two punched-out perforations of the stomach with extensive ulcerations. The author believes that these typical round ulcers are the result not so much of the direct action of the injected substances as of the hypersecretion provoked by them. The ulcer is in these cases a lesion of the glandular hypersecretion. From a practical point of view small doses of an extract of the gastric mucosa are powerful excitants of the gastric secretion; large doses produce dangerous lesions.

The Pace-maker of the Heart.—LEWIS (*Heart*, 1910, ii, 23) has made use of galvanometric methods to identify the seat of the auricular impulse formation. He found that a contraction of the auricle, excited artificially in the neighborhood of the base or inlet of the superior vena cava, invariably yields an auricular complex of the normal heart beat. No other area of the auricular musculature, when stimulated, propagates a contraction which yields an electric curve of the same type, but the complex in its general conformity approaches the normal type most nearly according as the point excited approaches the superior vena cava. It is believed that the electric curve is distinctive of the course pursued by the contraction wave. Therefore, the deduction is clear that it indicates the point at which such a wave of contraction starts. The shape of the auricular complex accompanying heart beats artificially provoked and starting in the area of the superior cavo-auricular junction, provides convincing evidence of the proximity of this junction and the pace-maker of the heart. A more accurate localization is impracticable with the present methods, but the observations narrow the field of enquiry to a comparatively small area in the immediate neighborhood of Keith and Flack's node.

Bronchial Asthma as a Phenomenon of Anaphylaxis.—MELTZER (*Jour. Amer. Med. Assoc.*, 1910, lv, 1021) attempts to interpret the asthmatic paroxysm as a phenomenon of anaphylaxis, assuming at the same time that the process is a peripheral one. This attempt is based upon the interesting facts discovered by Auer and Lewis, who seem to have established the true cause of the anaphylactic shock in guinea-pigs. They have definitely proved that the cause of acute anaphylactic death in guinea-pigs is a stenosis of the bronchi due to a tonic contraction of their muscle fibers. It is sure from their experiments that these contractions are not due to central impulses. The lungs are distended from the onset and remain so even when removed. Curare beforehand

does not influence the condition. The attack occurs likewise in animals with destroyed central nervous system. A previous injection of atropine will prevent the attack. The attack will occur in animals with the vagus nerves cut. So in an anaphylactic attack the bronchi are constricted; no air can pass into the alveoli, nor can it escape from them; and the lungs are greatly distended and cannot collapse. The constriction of the bronchi is of peripheral and not of central origin. Exactly similar symptoms are met with in the so-called nervous or bronchial asthma. During the attack the bronchi are constricted and air passes through with great difficulty. The following parallel facts are important. The sensitization to anaphylaxis may be hereditary or acquired. Anaphylaxis is specific; animals sensitized to a definite protein can be intoxicated only by that protein. The same seems to be true also for asthma. It is certainly true for the hay-fever asthma. Atropine which relieves asthma relieves also the anaphylactic shock. The theory is offered that asthma is an anaphylactic phenomenon; that is, that asthenics are individuals sensitized to a specific substance and the attack sets in whenever they are intoxicated by that substance.

Methods of Diagnosis of Anterior Poliomyelitis from Spinal Fluid and Blood.—GAY and LUCAS (*Arch. Int. Med.*, 1910, vi, 330) have attempted to find a method of diagnosis from the blood or cerebrospinal fluid in cases of anterior poliomyelitis, both in monkeys and human beings. They proceed along two lines of investigation—the examination of the blood or spinal fluid by recognized clinical methods, and testing the fluids by certain biological reactions of immunity. In the acute stage the leukocyte count showed a consistent and early fall. Previous to this, in the incubation and prodromal periods, it was quite stationary. The average of fifty differential counts in the acute stage was: Polymorphonuclears, 40 per cent.; large mononuclears, 15 per cent.; lymphocytes, 40 per cent.; eosinophiles, 5 per cent.; a slight lymphocytosis, and slight eosinophilia. In the spinal fluid were more characteristic changes. There was a marked increase in the number of cells during the incubation and prodromal stages and the early days of the acute period, being highest in the prodromal stage. These cells were at first mononuclears and were later replaced by polymorphonuclears. A fibrin clot appeared in the early and acute stages, but disappeared later. These findings agreed in both monkeys and human beings. The serum tests corroborated and extended the negative findings of Wollstein. There was no evidence of antibodies in the serum of monkeys taken at intervals during the acute disease or in the serum of unsuccessfully inoculated monkeys. There was, as well, no evidence of antigen in the spinal fluids of monkeys or of human beings at various stages in the disease, or in the blood serum.

Experimental Endocarditis Produced by Drugs.—WALKER (*Proc. Amer. Soc. Advancement of Clinical Investigation*, 1910, reprint from *Boston Med. and Surg. Jour.*, 1910, clxii) undertook a study of chronic heart lesions produced experimentally by the injection of sparteine sulphate followed by the injection of adrenalin chloride. They showed that drugs introduced into the circulation will produce proliferative changes in the endocardium. The most marked changes were in the endo-

cardium covering the papillary muscles, though they occurred elsewhere, even in the auricles. The valves were free in most cases. The endocardial lesions were practically confined to the animals that received spar-teine sulphate and adrenalin chloride. Uranium nitrate, potassium bichromate, and arsenic in various forms caused constant renal changes, but had no effect upon the endocardium.

SURGERY.

UNDER THE CHARGE OF

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Bone Suture with Bands of Fascia.—RITTER (*Zentrbl. f. Chir.*, 1910, xxxvii, 113), in a case of fracture of the surgical neck of the right humerus, in a woman aged seventy years, exposed the shoulder-joint by the Ollier, anterior, oblique incision and opened the joint. A large quantity of bloody serum was present in the joint and was sponged out. The fracture was then exposed and the fragments were perforated by a drill. Fascial strips taken from the right thigh were passed through the holes in the fragments by means of suitable forceps. By strong tension on these sutures, as when wire is employed, the fragments were drawn together and the sutures fixed to the neighboring periosteum. The capsule was sutured, and then the fascia and skin, and an aseptic dressing applied. The limb was immobilized by a dorsal plaster splint, reaching from the shoulder to the hand. Healing occurred by first intention. Complete consolidation of the bone was present one month later. The x-rays showed the fragments accurately approximated. Experimental investigations concerning the fate of the fascial strips are being made.

The Importance of the Operative Treatment of Cancer; Eight Cases of Permanant Cure after Operative Removal of the Upper Jaw.—KÖNIG (*Archiv f. klin Chir.*, 1910, xcii, 913) says that the results of operation for malignnat growths during the last ten years have progressively improved because of the increasing thoroughness in the removal of the tumor, the neighboring lymph nodes when possible, and the surrounding fat, connective tissue, and lymphatic vessels. When we realize that cancer for a time is a local condition, cancer of the upper jaw should be given an especially good prognosis, since secondary involvement of the lymph nodes is very rare. In his 48 total resections of the upper jaw for cancer, performed between 1875 and 1895, König found only

two in which the lymph nodes were involved. Therefore, radical removal of the tumor alone is necessary, but no partial operation should be done. Today the total operation becomes the rule more readily because prosthetic apparatus can be substituted so satisfactorily that the loss of the jaw is hardly noticed in eating and speaking. Not only should the resection be total, but its boundaries should be extended widely. It will often be necessary to pass beyond the median line in the mouth, to include the zygoma and not only the lower wall of the orbit, but the lateral and sometimes the upper, even to the dura or to the optic foramen. After the removal of the jaw with the tumor, the depth of the wound, the base of the cranium, and the pterygoid process must be examined, and, if necessary, cleared. Before completing the operation, one must convince himself that only sound tissue remains. The determination of the involvement of the brain should, of course, end the operation. König refers briefly to a case incompletely operated on in 1884, which in a short time recurred in such a manner that the orbital cavity was filled by the growth with severe exophthalmos. At the earnest request of the patient, who threatened suicide, and against his own advice, he operated again. The colossal defect was filled in by a transplanted flap. The patient is living today, twenty-six years after the last operation. Of the 48 cases, 19 died as the result of the operation; 2 died in the first and second years after operation without recurrence. Two others were operated on too recently to be available for these statistics. Of the 8 cases permanently cured, one died eleven years after the operation from an injury of the chest and lung, but was then free of recurrence. Another died nineteen years after operation of the infirmities of old age, at the age of eighty-five years. The six others are free of recurrence, twenty-six, twenty-three, twenty-three, twenty-two and one-half, twenty-one, and nineteen years after operation.

Surgical Treatment of Duodenal Ulcers.—VAUTRIN (*Archiv. gén. d. chir.*, 1910, vi, 771) says that in the treatment of cicatricial stenoses of the duodenum, so often complicated by the presence of atonic ulcerous lesions which are subjected to unexpected and sudden accidents, palliative operations should be preferred, such as gastro-enterostomy, which can diminish the dangers of the lesions but cannot entirely eliminate them. It is preferable to have recourse to operations which avoid the complications, that is to say, exclude the duodenum, or to duodenectomy, which gives complete security. Yet in valuing the surgical measures to be employed in the different cases, one ought to be guided by the importance and extent of the lesions, the resistance of the subjects, the age and the fear of complications and degenerations. The indications for resection will be fewer than those for exclusion, which, however, does not take into account the extension of the affection to a long portion of the duodenum, to neighboring organs nor their fixation. Exclusion with gastro-enterostomy will then be generally executed. Resection will be reserved for the rare cases in which the cicatricial stenosis is confined to the descending portion of the duodenum without close and resistant adhesion with the neighboring organs. It is especially against the recent duodenal ulcer in evolution that duo-

deneectomy finds its most useful indications. This will be the operation of the future. Under these conditions circular resection is not surrounded by the same difficulties as when there is a chronic periduodenitis. Moynihan has already shown its value.

Four Attempts at Arteriovenous Anastomosis.—MAUCLAIRE (*Arch. gen. d. chir.*, 1910, vi, 815) reports four unsuccessful efforts to improve the vascular conditions in senile gangrene by arteriovenous anastomosis. The analysis of them shows that they were unfavorable cases for this method of treatment. In the first the force of the arterial current was too weak to overcome the valves in the femoral vein, and this with the roughened condition of the internal coat of the artery, explains the consecutive arterial thrombosis. The temporary ligature employed may also have been at fault. In the second case the thrombosis extended high in the femoral artery. In the third and fourth cases the hyperpressure in this artery justified the application of the permanent ligature to the artery because it was thought that the sutures would not withstand the blood pressure. Mauclore believes that arteriovenous anastomosis has a very limited application in senile gangrene. It seems that the degenerative changes in the artery are often so marked that one cannot be certain that clotting in the artery will not occur. Probably better conditions are necessary for the success of this operation than exist in the cases of senile gangrene in which it has been done up to the present time. It should be done early, when the blood has sufficient pressure to force the valves of the veins and to reach the capillaries. It may prove that transplantation of a vein will be preferable to arteriovenous anastomosis, since the vein may take on characteristics of an artery.

The Treatment of Chronic Gonorrhœal Urethritis.—JUNGANO (*Ann. d. mal. d. org. gén.-urin.*, 1910, ii, 1315 and 1453) says that there is no one method of treatment. In chronic gonorrhœa the employment of disinfectants is justified only when the lesions are superficial. Generally it happens that through the gland ducts or the superficial lymphatics laid bare by inappropriate treatment, the infection passes deeply, when the disinfectants will prove ineffective. On the other hand, the body can react against microbial infection, and various anatomical lesions are found. All therapeutic measures which are limited in their action to the surface only will be insufficient, and in the deeper and more chronic lesions they are ineffective. The therapeutic difficulties in these cases can be appreciated when we compare the deep urethritis to innumerable urethral fistulæ, with, at times, obliteration of their orifices. Slow methods of treatment should be employed. Massage is the more rational. Experience shows that it can suffice without the aid of other measures. Ionization, by softening the tissues, can render massage more effective. Mild methods should always prevail.

Propagation of Tuberculosis from the Fallopian Tubes to the Bladder.—CUTURI (*Ann. d. mal. d. org. gén.-urin.*, 1910, ii, 1537) says that the walls of the bladder in contact with the Fallopian tubes are traversed by tubercle bacilli from within outward, and a tuberculous area of the

bladder wall is developed at the point of contact. The experimental condition corresponds clinically to certain forms of tuberculous cystitis secondary to the same condition in the uterus and tubes. The bladder may then be infected by the transperitoneal route as well as by the urethral and renal paths and by the blood and lymph vessels. The bladder rendered receptive to the bacillus of Koch by rectal tuberculosis, presents the maximum of tuberculous lesions upon the mucosa, the minimum in the muscularis and serosa. From a rectal tubereulosis the bladder is infected by the lymphatic path. There is no transperitoneal infection from the rectum to the bladder.

Inflammatory Strictures of the Prostatic Urethra.—GIROLAMO (*Ann. d. mal. d. org. gén.-urin.*, 1910, ii, 1580) says that inflammatory strictures of the urethra undoubtedly occur and are more frequent than is believed. Anterior and prostatic strictures have the same histological structure and the same evolution. A prostatic stricture is always associated with one or more strictures in the anterior canal. Their age differs, the anterior developing earlier than the prostatic strictures. The constriction of the anterior canal does not permit exploration of the condition of the posterior urethra. The caliber of the anterior urethra must be enlarged. The exploration of the prostatic urethra, to be successful, should be made with olivary metallic sounds conducted on a stylet. In the treatment of prostatic strictures, because of the slight dilatability of this portion of the urethra and the co-existence of anterior strictures, it is necessary to employ exclusively guided circular electrolysis acting at the same time upon both strictures. Girolamo's results have been both positive and constant.

The Treatment of Tuberculous Coxitis.—NEUBER (*Archiv f. klin. Chir.*, 1910, xciii, 96) calls attention to the great divergence of opinion which exists among surgeons concerning the treatment of tuberculous coxitis. Neuber sees few cases which he regards as suitable for conservative treatment. Those which have been treated a long time usually suffer from severe forms of the disease, as from abscesses, fistulæ, displacements of the head of the femur, contractures, and marked muscle atrophy. Often the x-rays show carious changes, rarely circumscribed foci, that have not yet perforated into the joint. The general condition is usually good and severe disease of the internal organs does not exist, so that Neuber regards resection as indicated. In doing this operation the anterior incision is employed, the sartorius and rectus are divided transversely near their origins and pushed downward. The iliopsoas muscle and anterior crural nerve are retracted inward and the anterior portion of the capsule freely exposed. He protected the large wound surface with vioform gauze before proceeding further with the operation. The capsule is opened in the axis of the neck and its upper attachments separated, following the acetabular margin, the prominent border of which is chiselled away. The escaping pus is then removed with sponges, the femur strongly hyperextended and rotated outward, and the prominent portion of the almost always diseased femoral head removed with a Gigli saw. This permits so complete a luxation that the diseased tissue can be removed with saw, chisel, and bone forceps,

and the head remodelled from the remaining portion of the neck. The epiphyseal line in children can rarely be preserved, but this is not of great importance, since the femur grows in length mostly from the lower epiphysis. The wound surface of the femoral neck is protected by gauze and the joint cleaned out, especially the acetabulum, even into the pelvis, and including the joint membrane, together with the psoas bursa. The whole joint wound is wiped thoroughly with a 5 per cent. formalin soap and abundantly washed out with fresh gauze. It is then dried and a 5 per cent. iodoform emulsion injected. Vioform gauze tampons are introduced, and the capsule, muscle, fascia, and skin sutured, leaving only a sufficient opening for gauze drainage. Sometimes primary healing can be obtained by early removal of the gauze and the further injection of iodoform emulsion. The operative and further functional results are encouraging.

The Fate of Living Bone Transplanted in Soft Tissue.—POKOTILO (*Archiv f. klin. Chir.*, 1910, xciii, 143) says that Barth, on the basis of his numerous and exact investigations, concluded that living bone which has been transplanted in the form of a completely isolated piece always disappears. It becomes replaced by connective tissue whether it has been covered by periosteum or not. This means that living bone undergoes the same fate as dead decalcified bone. Pokotilo had occasion to remove a transplanted plate of bone covered with periosteum, taken from the anterior surface of the tibia and employed to build up a sunken nose. It developed that the piece had been too small, so that a second operation was necessary, which was done ten days after the first. According to Barth, in this time the cells of the bone had died and the regenerating process had begun. The examination of the piece of bone showed that the osseous tissue had entirely disappeared and apparently that a piece of bone covered with periosteum is capable of producing bone.

Permanent Results of Osteoplasty in Animals.—FRANGENHEIM (*Archiv f. klin. Chir.*, 1910, xciii, 191) made an extensive study of this subject. He says that transplanted bone covered with periosteum retains the power of bone production even when transplanted into another animal of the same species. The bone formed from the transplanted periosteum was not as great in quantity as in the osteophytes which developed at the site of resection. The ossification is not symmetrical in the whole circumference of the transplanted piece. In no case was cartilage developed from the transplanted periosteum, while the periosteum of the remaining bone from which the piece was taken did form cartilaginous tissue. Periosteum covered living bone is the best material for transplantation, because the ability of the periosteum to form bone is regularly retained. The preservation of the medulla in the transplantation of bone in animals was shown to be an advantage, because it also was found to have the property of forming bone, and its preservation is recommended. When bone was transplanted without periosteum it was observed that a periosteum was regenerated from that of the bone to which it was transplanted. The periosteum, especially that of the proximal fragments, as well as that of the osteophytes which developed, extended around the transplanted bone, and after the

absorption of the osteophytes the bone previously devoid of periosteum possessed a covering of connective tissue which was continuous with the periosteum of the original bone. The bone formation, the resorption and substitution of the transplanted bone, occurs chiefly from the bone defect in which the new piece is placed, and develops the more rapidly the more exact the contact between the transplanted piece and the surface of the defect. Macerated bone can be employed satisfactorily for the filling in of a bone defect, especially when the defect is well filled and the transplanted bone is in intimate contact with the ends of the bone containing the defect. But the resorption and the substitution of the macerated bone occurs much more slowly than when living bone is transplanted. Firm adhesion to the surrounding soft tissues occurs only after a longer time. In one case, when transplanted living bone had already healed in and had been substituted by new bone (after half a year), macerated bone was found still lying loose in the tissue and substitution by new bone had hardly begun. When it has been shown, by numerous operations on men, that it is more difficult to obtain primary aseptic healing of macerated than of living bone, the employment of macerated bone for transplantation will be restricted to exceptional cases.

Subcutaneous and Intravenous Nourishment with Grape Sugar.—BERENDES (*Zentralbl. f. Chir.*, 1910, xxxvii, 1217) says that many attempts have been made, experimentally in animals and in sick men, to supply nourishment subcutaneously with such substances as cod-liver oil, olive oil, sugar solutions, Siegfried's pepsin-fibrin-peptone, and other albuminous foods. Although many satisfactory results have been obtained, subcutaneous nourishment is not systematically employed. Kausch has been employing this method for a long time in patients who have been operated on. The nourishing material was mixed with saline solution and was given subcutaneously and intravenously. Berendes reports concerning the results in Kausch's cases in which glucose was employed. It was given in a 0.9 per cent. sterilized saline solution, which was usually of light-yellow color and thinly fluid. Subcutaneous absorption of this fluid was slightly slower than when a pure saline solution was used, and the one gave no more pain than the other. During the introduction intravenously there was no pain, the patient at most complaining of a feeling of heat in the head or in the wound. In general there was a feeling of warmth and slight discomfort, and the pulse became stronger. The temperature remained unchanged after the infusion, except in two cases, in which, immediately afterward, chills and a temperature of 39.5° and 40° C. occurred. In both the temperature fell to normal after a few hours. Examinations of the urine made before and after the infusion never showed sugar, when the amount introduced amounted to 50 grams (1 liter of a 5 per cent. solution)—in children correspondingly less. Only when the infusions were continued for several days was there a very slight amount of sugar in the urine in the later days. After one infusion of 75 grams (1 liter of a 7.5 per cent. solution) there was no excretion of sugar. From a single infusion of 80 grams and upward sugar appeared in the urine, but in a surprisingly small amount. It was observed that generally when sugar appeared in the urine, it did so in catheter urine immediately

after the infusion and then gradually disappeared. The excretion of sugar depends manifestly upon several factors—the amount of sugar introduced, its concentration, the duration of the infusion, the body weight of the patient, the degree of inanition, and the existing trouble. The patient did not suffer from the excretion of sugar or the infusion. The sugar retained in the body was manifestly used up.

THERAPEUTICS.

UNDER THE CHARGE OF

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The Results Thus Far Obtained in the Treatment of Syphilis with the Preparation of Ehrlich-Hata.—PICK (*Wien. klin. Woch.*, 1910, xxiii, 1193) bases his conclusions upon 120 cases treated with "606." He says that this preparation develops a specific action such as has never been seen before in the treatment of syphilis, and is comparable to the action of quinine in malaria. He noticed a recurrence of the symptoms in only 2 cases. He says that recurrences and the incomplete cure of certain forms with the small doses at present used do not detract from its specific action. The principal indications for this remedy are malignant syphilis, obstinate syphilitic affections of the mucous membranes, and in early cases as a preventive measure. He found that the Wassermann reaction changed from positive to negative in most cases after four weeks. The shortest interval between the positive and negative reaction was twelve days, and the longest yet observed was seven weeks. He has not observed any such bad after-effects as those described by Bohac and Sobotka which he thinks might possibly be explained by a direct injury to the sciatic plexus. The injections frequently caused a rise in temperature, but the temperature was high (103.5° F.) in only one case. He also observed that there frequently followed a diminution of the amount of the urine. The patients in which this occurred had profuse perspiration, lost their appetite, and complained of thirst. An erythematous eruption was also frequently observed at the site of the injection.

Experiences with Ehrlich's "606" in Syphilis.—ISAAC (*Berl. klin. Woch.*, 1910, xlvii, 1528) reports 27 cases with details. The patients entirely recovered from severe manifestations of the disease in an average period of ten days. No serious symptoms were observed, but Isaac thinks that under certain circumstances the remedy is attended with certain dangers and should be used only when there is no serious internal disease associated with the syphilis. Pain after the injections seems to be often due to individual factors. Two of his patients had considerable pain which was associated with fever and some infiltration in the gluteal region. This was severe enough to require the use of large doses of morphine for several days.

Theoretical and Practical Views in Regard to Ehrlich's "606."—KRO-MAYER (*Berl. klin. Woch.*, 1910, xlvii, 1585) reports 27 cases. Five of these already show a recurrence, and in 3 other cases some of the symptoms persisted after the injection. He found that a positive Wassermann reaction became negative in only 25 per cent. of the cases. His results as to the curative effects of the preparation agree for the most part with other published observations.

"606" Ehrlich's Newest Remedy for Syphilis.—MELTZER (*New York Med. Jour.*, 1910, xcii, 371) reviews briefly the early history of the preparation denoted "606" by Ehrlich and Hata, and recommended by them as a specific for syphilis. This remedy was first tested by Iverson in St. Petersburg, on cases of relapsing fever, with most gratifying results. After one injection all spirilla disappeared from the blood, and under a critical profuse perspiration the patient recovered. Since then the remedy has been widely used in all forms of syphilis by many different observers. Meltzer says that rarely, if ever, has there been such unanimity in medical statements as in the enthusiastic reports over the effects of the Ehrlich-Hata preparation. The spirochetes disappeared, primary affections lost their induration, ulcers cleaned up and were rapidly covered by epidermis, headache, periosteal pains, paralyses, etc., disappeared. The patients felt well and gained in weight—all this, after a single injection and in a comparatively short period of time. The question whether the cure will remain permanent can only be answered by the future. A large number of patients have remained cured for many months. In only a very small fraction of the cases have there been relapses; in these cases the injected dose was apparently too small. Over the fate of the Wassermann reaction the reports differ widely; some have seen it become negative in 100 per cent. of the cases, others only in 40 per cent. and less. In all the cases the change in the reaction recurred much later than the disappearance of the syphilitic manifestations. There was a close watch for any untoward effects upon the kidneys, eyes, etc., but no complications were observed. The report of two writers (who observed only 14 cases) that in 3 of these there was paralysis of the bladder, reduction of the reflexes, etc., was apparently due to their faulty technique and to the use of too impure methyl alcohol. No other observers, who studied hundreds of cases, have ever observed such complications. One unpleasant complication with which many had to contend is the causation of pain, which sets in late and lasts for many days. This, however, seemed to have occurred only when the injection was given intramuscularly in the gluteal region. This applies also to the slight elevation of the temperature. Intravenous injections cause no pain. Meltzer says that the facts regarding the best methods of dissolving the substance, the mode of injection, the dose to be used, and other details will be carefully established before the new preparation is handed over to the general practitioner.

Arsenobenzol in Syphilis.—SPIETHOFF (*Münch. med. Woch.*, 1910, lvii, 1822) states that his experience with arsenobenzol in the treatment of 50 cases of syphilis shows that it has a curative action. He also narrates a number of untoward effects that, however, were transitory. In 2 cases

he observed a sudden total blindness that, however, lasted only for a few minutes. In a few other cases scotomas were noted on the day of the injection. Tachycardia was also observed in a few cases, but subsided when the patients were in a recumbent position. In one case there occurred convulsions that resembled an epileptic attack. These convulsions occurred four hours after the injection of 0.3 gram of the remedy. There were also 2 cases of skin eruptions that resembled the exudative form of erythema multiforme. One patient, a poorly nourished, anemic woman with tertiary lesions in the throat, was found dead in bed following an injection of 0.5 gram of arsenobenzol. Ehrlich attributes the death of this patient to shock from the local pain at the site of the injection. Spiethoff gave the remedy by intramuscular injections, and gives in his article the technique of the method of administration. He thinks that the contraindications for this remedy are rare. The chief one is a weakened and lowered vitality associated with serious non-specific organic changes, particularly of the circulatory organs.

Do Special Dangers Attend the Intravenous Injections of "606."—EHRlich (*Münch. med. Woch.*, 1910, lvii, 1826) does not believe that the intravenous injection of "606" presents special dangers. He thinks that patients with very far advanced degenerative processes of the central nervous system form a special group in which treatment by arsenobenzol is contraindicated. In the fatal case reported by Fränkel and Growven, after intravenous injection there was extensive disease of the brain associated with marked myocardial disease, and therefore Ehrlich does not think that it was a suitable case for the treatment. In two similar cases death has resulted after subcutaneous and intramuscular injections of the remedy. He thinks that small doses from 0.3 to 0.5 gram may be injected into the veins with safety when there is no serious disease of the brain, arteriosclerosis, or functional disturbance of the heart, particularly angina pectoris. He adds that the preferable technique may possibly be first an intravenous, followed in forty-eight hours by an intramuscular injection, thus dividing the dose in two portions.

The Action of Ehrlich's Arsenobenzol in Syphilis.—HERXHEIMER and SCHONNEFIELD (*Med. Klinik.*, 1910, vi, 1400) report a number of cases of various forms of syphilis in which the results obtained by Ehrlich's "606" were brilliant. They discuss the advantages and disadvantages of the different methods of injection. Intramuscular injections are more painful and frequently cause infiltrates in the muscles. Intramuscular injections are made in the left gluteal muscle in its upper and outer quadrant to avoid the neighborhood of the sciatic nerve. They advise making subcutaneous injections between the shoulderblades and massage to hasten the absorption of the remedy. They found that neutral suspensions of the remedy caused less severe pains than acid solutions. They advise, before beginning treatment, a careful examination, to determine whether the heart and kidneys are normal. Heart or kidney disease, fetid bronchitis, and especially changes in the optic nerve contraindicate this treatment. Herxheimer and Schonncfield have treated over 200 cases with but one recurrence.

The Treatment of Syphilis with Ehrlich's "606."—WECHSELMANN (*New York Med. Jour.*, 1910, xcii, 449) has treated over 600 cases with Ehrlich's arsenobenzol. He prefers the subcutaneous administration of a neutral suspension, and describes in detail the method followed by him. He says that such injections produce very little pain. On the third or fourth day there often appears a more or less marked swelling at the site of the injection. As a rule, a single injection of 0.3 gram was given, although a repetition of the dose was necessary in a few cases that recurred. These recurrences were not widespread and severe, such as occur after mercurial treatment, but only a recurrence of a few isolated local lesions. Isolated cases have remained refractory and required a second injection. Wechsellmann has observed no untoward effects, but he cautions that its use must be carefully guarded in patients with a weak heart. He also speaks of the possibility of damage to the optic nerve. He has not seen clear results in cases of progressive paralysis, although he thinks that a trial should be made in the early cases. He has noted rapid improvement in a number of cases of tabes.

Untoward By-effects after the Administration of Ehrlich's "606."—BOHAC and SOBOTKA (*Wien. klin. Woch.*, 1910, xxiii, 1132) complete the histories of 3 patients who had serious bladder disturbances after the administration of "606." In one of these patients complete retention of urine persisted for ten days and rectal tenesmus for some time longer. The reflexes which at first were absent had returned, but were sluggish. They add 4 more patients in whom the improvement obtained by the injection of "606" was very temporary. They do not believe that these untoward symptoms are explained by the hypothesis of methyl alcohol intoxication that is advanced by Ehrlich as the cause of them.

The Use of Ehrlich's Arsenobenzol in the Treatment of Syphilis.—NEISSER and KUZNITZKY (*Berl. klin. Woch.* 1910, xlvii, 1485) publish results that indicate the value of arsenobenzol in the treatment of syphilis. They discuss the introduction of the drug by intravenous, intramuscular, or subcutaneous injections, and favor the intravenous method. They say that final results are, of course, unknown as yet because the first patients were discharged only a short time ago. However, they believe that every syphilitic who does not present special contraindications should be advised to try this new remedy. Neisser and Kuznitzky think that it is especially indicated in all recent cases in the hope of a rapid and permanent cure; in every case that does not respond to mercury; and, finally, in cases overtreated with mercury. They believe that the effect of "606" on parasyphilitic affections is as yet unknown, but there seems to be no contraindication to its trial in paresis. However, the susceptibility of tabetic patients to optic atrophy may contraindicate the use of "606" with these patients.

The Treatment of Syphilis with "606."—HOFFMAN (*Med. Klinik*, 1910, vi, 1291) reports 6 cases treated with "606," of whom, 2 were benefited, a third showed a recurrence, and in the remaining 3 severe complications occurred. Two of these patients had a quite severe disturbance of the action of the heart that, however, gradually subsided.

The third patient developed an embolic central pneumonia following an intramuscular injection of the acid solution. In his experience with it by-effects were noticed only when the drug was in an acid solution, while they were absent when a neutral solution was used. He also refers to a case reported to have died suddenly as a result of a single injection of 0.3 gram of the remedy. EHRlich (*Med. Klin.*, 1910, vi, 1322) answers this remark concerning this fatal case. He refers to his instructions that the treatment is contraindicated in those patients with marked changes in the central nervous system. The patient in question was a woman who in 1906 suffered from a luetic apoplexy and had not yielded to several courses of mercurial treatment, and in the meantime had developed paresis of both legs, muscular atrophy, paralysis of eye muscles, tachycardia, etc. Ehrlich concludes, therefore, that this subject was not a suitable case for the treatment. He also excludes the metasymphilitic diseases from treatment with "606." He says that given with the proper technique and with proper indications the remedy is free from danger.

PEDIATRICS.

UNDER THE CHARGE OF

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Influenza in Infants.—S. WEISS (*Med. Klinik*, 1910, vi, 1441) observed two epidemics of influenza with unusual and irregular symptoms. One epidemic occurred in a "babies' home," where most of the infants were under two years of age. A seven months old child began this epidemic with fever, coryza, inflamed pharynx, and bronchitis. It recovered in six days. In less than a week all the children in that room fell ill with fever and anorexia, but none of them gave any physical signs such as the first case exhibited. Aspirin and cold sponges helped to clear up the cases, but the fever spread from child to child and even attacked the nurses, who exhibited typical adult influenza. The fever in the children was remittent in type, the lowest point occurring about 4 P.M., and the highest point in the morning. Two weeks after the epidemic disappeared a number of the children again fell ill with fever, cough, coryza, and great losses in weight. Aspirin here was useless, but quinine brought down the temperature. As there was no tendency to improve in a number of the cases the institution was closed and fumigated. In the second epidemic there was admitted to the hospital a child aged eleven weeks, suffering with fever, ileocolitis, conjunctivitis, coryza, and discharging ears. After several rapid declines in weight and frequent mucous stools, it died. The urine showed albumin and sugar. Three other children in the same room were shortly afterward taken with the same symptoms, ileocolitis and rapid loss of weight. Two recovered, but the third succumbed, showing albumin and sugar in the urine. In a former epidemic a wet nurse with influenza infected:

the nurses and help in a hospital and consequently a large number of the infants, 2 of which died. One showed at autopsy a bronchial catarrh and an enlarged spleen. The other showed enlarged spleen and a purulent pericarditis containing the influenza bacillus. The bacterial proof was found in this whole series of cases. A study of these epidemics shows that a number of children in a ward may have the mild form of influenza. Others in the same ward have the severe febrile type and infect their adult nurses, who develop typical adult influenza and re-infect the lately convalescent infants. The chronic form, with fever continuing for several weeks, is found also in children. A large number of investigators seem to agree that in infants the symptoms and pathology in influenza are usually preëminent in the gastro-intestinal tract, that the spleen is usually enlarged, and that albuminuria is fairly constant. The above epidemics showed a large number of infants with influenzal infection of the gastro-intestinal tract, with vomiting, anorexia, loss of weight, and diarrhœa. This type proved especially fatal in children with an already weakened digestion. Influenza in infants and children shows the same protean symptomatology as is found in the influenza of adults.

Examination of the Blood Serum of Idiots by the Wassermann Reaction.—H. R. DEAN (*Lancet*, 1910, clxxix, 227) tested by the Wassermann reaction children and young adults suffering from idiocy and imbecility, in an institution in Potsdam. The tests were carried out strictly in accordance with the original method, watery extract of congenital syphilitic liver being used as antigen in all the cases. In 330 cases examined, 51, or 15.4 per cent., gave the positive reaction. Among these 51 cases were 7 which showed definite signs of syphilis. Two cases with definite signs gave a negative reaction. In 287 cases of simple idiocy of all grades, 44 were positive. In 14 cases of marked hydrocephalus, 4 were positive. One case of epilepsy proved positive. Four microcephalic cases were negative. The cerebrospinal fluid in 12 cases showing positive reaction with serum gave a positive reaction in but one case. Specimens of serum from the parents of 10 children showing positive reaction were tested with the following results: Out of 13 parents tested, 9 gave a positive reaction. In the case of one parent, a positive result was obtained fifteen years after, and in another case sixteen years after the birth of the syphilitic child. Grouping the 330 cases according to age showed the following results: 94 cases of ten years and under gave 21.27 per cent. positive reactions; 142 cases from eleven to fifteen years inclusive gave 16.9 per cent. positive reactions; 66 cases from sixteen to twenty years gave 6.06 per cent. positive reactions. This appears to show that the percentage of positive results diminishes rapidly after the sixteenth year, and that the average age of patients investigated is an important factor in any estimation of the prevalence of congenital syphilis. Numerous investigations tend to prove that the evidence of a positive serum reaction may be accepted even in the absence of the usual signs and symptoms of the disease. No symptoms or group of symptoms could be detected which were common to all the positive cases in Dean's series, so that if a causal relation exists between congenital syphilis and idiocy the condition which arises might be classed as parasyphilitic. Dean thinks it reasonable to

believe that many cases of idioey should be classed with that form of syphilis which manifests itself alone by a selective toxic action on the elements of the central nervous system and to infer a causal relation between the two conditions.

Fatal Lead Poisoning in a Two-year-old Child from Sucking a Painted Bedstead.—HIRSCH (*Berl. klin. Woch.*, 1910, xlvii, 1820) reports the following case of lead poisoning in a two-year-old child. The child was brought to him with the history of continued vomiting and colic for six weeks. On the strength of this it had been treated at some clinic for whooping cough. The child vomited all food and was constipated. There was great pallor and emaciation and a scaphoid abdomen very painful to palpation. He elicited the history that for weeks the child had been gnawing and sucking at its bedstead, which had been painted by the child's father, who was employed in a dye and paint works. Inspection of the bed showed that the paint had been sucked off an area about 4 by 8 inches. Scrapings of the paint and a small portion of the child's feces both showed a large percentage of lead by chemical analysis. The child developed a weak, irregular pulse, and fatty renal epithelium and casts, with traces of lead, were found in the urine. Pneumonia developed and terminated fatally. No blue line was found on the gums. Autopsy and microscopic findings showed fatty degeneration of the myocardium, the liver, and especially the renal epithelium, with the presence of pneumonia. Hirsch points out the danger from bedsteads painted with any preparation containing lead or zinc, since children often have the habit of gnawing and sucking at their bedsteads. He advocates laws forbidding the employment of paints containing lead or zinc for such purposes.

Convulsions in the Course of Whooping Cough and their Treatment.—J. IBRAHIM (*Med. Klinik*, 1910, vi, 895) states that general convulsions belong to the most serious complications of pertussis, and that their occurrence usually indicates a bad prognosis. This complication is most frequent during the first year of life, and almost as frequent in the second. The convulsion usually starts during the height of the spasmodic cough. It is not always found in the severest cases of pertussis, but occurs as well in the mildest cases and when least looked for. It may appear unassociated with the paroxysm. The convulsions are eclamptic in character and rarely limit themselves to one group of muscles, but are generalized, involving the face and accompanied by unconsciousness. The length of the individual attack varies from a half to one minute, in the usual cases, to five minutes and even an hour in the severe forms. Consciousness may not be impaired between the attacks, but there is usually a stuporous, drowsy condition and often a rigidity of the neck and a condition similar to meningitis. Extremely high fever usually accompanies the convulsions, often 41° C., the highest recorded being 43.4° C. This high temperature is probably best explained by an involvement of the centres of heat production. Autopsies on fatal cases of this kind show no macroscopic changes in the brain and its membranes, except a slight congestion and extravasation of serum. Neurath found microscopically a meningeal infiltration, mostly of mononuclear leukocytes, hyperemia, and small meningeal

hemorrhages. This condition he found also in other children dying during pertussis, but not showing convulsions. Ibrahim is inclined to believe that a spasmophilic diathesis and even an hereditary syphilis may predispose to convulsions during pertussis. The usual treatment of the convulsion by bromides, chloral, and warm baths is useful, but fails in many cases to prevent a fatal ending. Lumbar puncture in addition to the usual treatment promises to be of value in these cases, and has been used by a number of investigators who speak favorably of its results. Hot packs should be given with circumspection and never employed in a case in which a spasmophilic diathesis is present or suspected. Besides general convulsions, pertussis is sometimes complicated by spasmodic conditions, either localized or as general tonic or clonic spasms. These are followed by paralyses of various forms, which are similar to typical hemiplegias and paraplegias, and in some cases become permanent. Some of these paralyses recover so quickly as to suggest cerebral œdema as a possible cause. Autopsies have shown, however, that only a few of these cases exhibit actual cerebral extravasations of blood; so that infections and toxic changes in the brain may also be a possible cause for these conditions. When recovery is slow or prolonged Ibrahim advises lumbar puncture as a final and justifiable last hope for improvement.

OBSTETRICS.

UNDER THE CHARGE OF

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The Surgical Treatment of Puerperal Septic Infection.—VINEBERG (*Surgery, Gynecology, and Obstetrics*, July, 1910), among others, reports 6 cases in which the pelvic veins were ligated in the treatment of puerperal septic infection. In one case of general sepsis the removal of the uterus was accompanied by ligation of the pelvic veins. This patient recovered. The second case, after abortion, was treated in the same manner, but developed diphtheritic infection of the throat and died. The third case, of chorio-epithelioma, infection developed and the uterus was removed. It was not possible to ligate the veins. Death followed in this case. Autopsy showed chorio-epithelioma with metastases in the lungs. In the fourth case the right ovarian vein was ligated and excised for puerperal septic thrombophlebitis. Death followed, and at autopsy the vena cava was found thrombosed at the site of entrance of the right ovarian vein, the thrombophlebitis extending down to the common iliac and tributaries. His fifth case was puerperal septic metritis from streptococcal infection and thrombophlebitis. Hysterectomy and ligation of the right spermatic vein were employed, followed by recovery. The right spermatic vein showed a degenerated clot filled with streptococci. The sixth case was that of acute puerperal septic infection with vaginal

pelvic suppurating sinus. Hysterectomy was done with high ligation of the right spermatic vein, followed by recovery. A seventh patient presented a traumatic rupture of the uterus, with severe bruising of the cervix, vaginal walls, and pelvic structures. Abdominal panhysterectomy was performed when it was found that a tear in the right fornix had extended into the base of the broad ligament, lacerating the veins, the blood being effused into the cellular tissues of the broad ligament, forming a blood tumor the size of the fetal head. This tumor was enlarging, and hemorrhage could not have ceased without operation. After removing the uterus the blood tumor was evacuated, the bleeding points ligated, and the pelvic cavity packed with iodoform gauze. The patient made a tedious but complete recovery.

Rupture of the Uterus after Cesarean Section.—DAHLMANN (*Monatsschrift f. Geb. u. Gyn.*, 1910, xxxii, Heft 1) reports 3 cases of rupture of the uterus after Cesarean section, and quotes 23 collected from the literature. He refers to Krukenburg's paper in 1886, reporting 27 cases of rupture of the uterus in subsequent pregnancies, when the uterus had not been sutured at the time of delivery. He estimates the frequency of rupture in these cases, where suture was not taken, as 50 per cent. Sanger, in 1895, reported 500 cases of Cesarean section, in which the uterus had been carefully sutured, without a case of rupture in the scar. Dahlmann's first case was that of a patient who had had Cesarean section because the pelvis was blocked by a myoma of the cervix as large as a foetal head. The section was performed by transverse incision across the fundus. At operation two myomatous tumors behind the uterus were removed and the peritoneum stitched over the base of the tumor. Recovery was complicated by some elevation of temperature, but was finally complete. About a year afterward the patient was brought in moribund, with the history that after normal pregnancy the uterus had ruptured during energetic pains in labor. On section the abdomen contained a large quantity of blood, and on the left side of the fundus there was a considerable tear, through which the placenta projected. In this tear were traces of catgut fiber, and there were some adhesions between the uterus and the omentum. On microscopic examination it was found that the placenta had attached itself opposite the portion of the uterine muscle where the fibers after the first operation had terminated in scar tissue and had not been regenerated as muscular fiber. The right half of the uterus was covered with many adhesions to the omentum, the right cornu being higher than the left. The breech of the child lay in the right cornu of the uterus. The rupture extended from the right cornu, upward and downward toward the left. The muscle had become very thin in this portion of the uterus and the attachment of the placenta had served to lessen its strength. Case II had Cesarean section because of an exaggerated varicose condition of the vagina, which made vaginal delivery exceedingly unsafe. Incision was made in this case across the fundus. The muscle was closed with silk. The patient had a utero-abdominal fistula after operation, through which some of the silk was discharged. The fistula finally closed. During subsequent labor rupture of the uterus occurred, and upon section adhesions were found between the omentum and the uterus.

The entire uterine contents had been expelled into the abdomen. The uterus was slightly contracted. The uterus had ruptured at the site of the incision, through which there was a slight hemorrhage. Supravaginal amputation was performed. The patient made a good recovery. On microscopic examination the muscular tissue at the fundus was found to be largely replaced by scar tissue. Adhesions of the omentum over that portion of the uterus had undoubtedly had some influence in the development of the pathological condition. The third case was that of a patient who had Cesarean section by transverse fundal incision for contracted pelvis. The uterus was closed by catgut. In the second labor section was again performed, and a laceration the size of a silver half dollar, without hemorrhage, was found, in the middle of the old scar in the fundus. Through this the unruptured foetal membranes were protruding. There was some blood in the abdominal cavity. There were adhesions between the omentum, the uterine scar, and the anterior abdominal wall. The uterus was opened in the median line and the child extracted, the uterine scar of the first operation being found exceedingly thin. The uterine extremities of the tubes were excised and the uterus and abdomen closed. The patient made a somewhat tedious recovery. It is interesting to note that these ruptures followed cases in which the transverse fundal incision had been practised, instead of the longitudinal incision in the median line.

The Use of Momburg's Tube in Ruptured Tubal Gestation.—STOLZ (*Zentralbl. f. Gynäk.*, No. 41, 1910) reports the case of a patient, aged thirty-four years, who had a bloody vaginal discharge. She complained of cramp-like pain in the left portion of the abdomen. On examination, the uterus was enlarged and in Douglas' pouch; on the left side there was a round tumor which was elastic and easily pushed away by the finger. A diagnosis of threatened abortion or left-sided tubal pregnancy was made. A few moments afterward the patient suddenly complained of violent abdominal pain and collapsed. The pulse was very rapid and irregular, and the patient seemed in danger of death. An ambulance was at once summoned, but an hour elapsed before its arrival. Stolz in the meantime applied cold compresses to the abdomen, counter-irritation over the chest, elevation of the pelvis, and injections of camphor, under which the patient somewhat improved. Before placing her in the ambulance Momburg's tube was applied, but the patient complained bitterly of pain, and at the fourth turn of the bandage became unconscious. The bandage was immediately loosened, when the patient became better. She was at once transported to hospital and operated upon, followed by recovery. The case is interesting for the unfavorable result of the application of the Momburg bandage. Fränkel suggests that in these cases the bandage interferes with the remaining circulation, and that the heart becomes suddenly almost emptied of blood. It is thought that in cases of extreme anemia in which there has been no time to perform saline transfusion, Momburg's method is not applicable.

Transperitoneal Cesarean Section for Face Presentation and Threatened Uterine Rupture.—GERSTENBERG (*Zentralbl. f. Gynäk.*, No. 41, 1910) reports the case of a patient with contracted pelvis, with an external

conjugate of 18 cm., pregnant with a good-sized child in face presentation. The patient was a multipara, and her previous children had been large. Labor was protracted, the head failing to descend and a contraction ring clearly developing. The patient was transported to hospital and section performed by the transperitoneal method. On opening the uterus, the amniotic liquid escaped and contained a considerable quantity of meconium. The head was delivered with the hand and one blade of the forceps. The incisions were closed and drainage was introduced at the lower end of the incision. The child was 54 cm. long, weighing $8\frac{1}{2}$ pounds, and was deeply asphyxiated. It was revived, and made a complete recovery.

GYNECOLOGY.

UNDER THE CHARGE OF
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Clinical and Experimental Studies Concerning the Curative Action of Laparotomy in Peritoneal Tuberculosis.—F. HEIMANN (*Ztschr. f. Geburts. u. Gynäk.*, 1910, lxvi, 34) Thirty-six cases of peritoneal tuberculosis were operated upon in the Küstner clinic from 1898 to 1908, all of which showed improvement when discharged from the hospital. Of 28 cases whose subsequent course he was able to follow, 13 had died and 15 were in perfect health, with not a single recurrence. He reports a case operated upon thirteen years previously for peritoneal tuberculosis, in whom a second operation was required for some other condition. The peritoneal cavity showed no evidences of the former disease, with the exception of a few pelvic adhesions. The symptoms may be obscure, and not infrequently an exact diagnosis can be made only at operation. As an aid to diagnosis, old tuberculin was of the greatest service, since in almost every case a positive local reaction, as expressed by more or less diarrhoea and abdominal pain, followed its injection. Pulmonary tuberculosis, unless actively progressive, is no contra-indication to operation; in fact, the pulmonary lesions seemed to be benefited thereby. At operation every case presented either the exudative-scrous or dry form of tuberculosis. The operation consisted merely in opening the abdomen, with the evacuation of ascites. Irrigation with antiseptic solutions was not employed. The adnexa were not disturbed, even when presenting lesions suggestive of tuberculosis. Dysmenorrhoea and irregular menstruation, which were common symptoms, permanently disappeared after operation, and one patient gave birth to a healthy, full-term child. The administration of old tuberculin as a therapeutic agent was begun six or seven days after operation and continued for some time. Heimann believes that the good results can, in part, be ascribed to the tuberculin treatment. The conjunctival and von Pirquet reactions were used in the 15 cases regarded as cured;

the former was negative, the latter positive in every case. Laparatomy probably exerts a healing action by virtue of the hyperemia induced. As the result of his studies of experimental peritoneal tuberculosis in guinea pigs, the author concludes that the healing process which he observed is analogous to that in the human peritoneal cavity.

A Method of Anastomotic Repair of the Divided Ureter.—When the divided ureter is shortened to such an extent that implantation into the bladder or lateral uretero-ureterostomy cannot be performed satisfactorily, but in which the proximal and distal ends can be approximated, McLEAN (*Amer. Jour. Obst.*, 1910, lxii, 437) proposes a method which may be of service, although he has never tried it on the living subject. After carefully trimming the wounded ends at a right angle to the course of the ureter, a flexible ureteral catheter is passed downward through the lower end into the bladder and carried through the urethra by means of a Kelly cystoscope. The upper end is passed into the upper section of the ureter and the ends carefully approximated over the catheter with fine silk sutures. The peritoneum covering the ureter is closed. The catheter may be left in place for several days, and he suggests that a slight rotation may be advisable before attempting to withdraw it.

Contribution to the Operative Treatment of Benign and Malignant Tumors of the Ovary.—VANVOLEXEM (*Ztschr. f. Geburts. und Gyn.*, 1910, lxvii, 64) states that the debate during the Gynecological Congress at Kiel demonstrates divergent opinions concerning two important points in the operative treatment of ovarian tumors: the conservation or removal of the opposite ovary in malignant or suspiciously malignant tumors, and to what extent the vaginal route should be employed. The majority of operators lean toward radical excision. Glockner goes so far as to advocate removal of the second ovary in all unilateral tumors. Hofmeier recommends conservative principles even in the presence of carcinoma, while Pfaunenstiell maintains a neutral position, being guided largely by the nature of the tumor presented. The author presents the histories of 7 cases observed in the Frangue clinic at Prague, which serve to illustrate his views and to form a basis for his conclusions. In unilateral malignant ovarian tumors the second, apparently sound, ovary, together with the uterus, should be removed after the plan of radical operation for uterine carcinoma. If a unilateral tumor shows suspicious evidence of malignancy, a microscopic examination should be made at the time of operation, or if this is not feasible, immediately afterward, and if carcinoma be present, the radical operation should be performed without delay. Examination of the gross specimen fails to reveal malignancy in many ovarian tumors which are proved malignant by the microscope. In benign ovarian tumors the opposite ovary should be carefully inspected and in certain cases a piece excised for microscopic study. While the abdominal operation is the procedure of choice, the vaginal route offers the easier access in exceptional cases, especially in well-advanced pregnancy and during birth.

Periodic Intermenstrual Pain.—The occurrence, symptomatology, pathology, and theories of causation of this affection are discussed by

HEANEY (*Surg., Gyn., and Obstet.*, 1910, xi, 361), based upon three cases which have come under his observation and 63 cases which he has collected from literature. That the complaint is comparatively rare, is proved by Rosner's statistics, occurring only 12 times among 2350 patients. The largest number of cases is found during the age of greatest sexual activity, twenty-five to thirty-five. Married women are more frequently affected. The pain appears at a time midway between the menstrual periods, in those of the twenty-eight-day type on about the fourteenth day after the onset of the last menstruation. Once established, it appears regularly each month unless amenorrhœa be present, when it is usually absent, only to reappear with the return of menstruation. The pain, as a rule, begins in one side of the abdomen, more frequently the left. At the onset the pain is spasmodic, with intervals of complete cessation; later, however, it extends over the whole lower abdomen and becomes more or less continuous. The duration is usually two or three days, although it may persist until the onset of menstruation, which is followed by complete relief. In a certain proportion of cases the pain is associated with a thin, watery, or mucoid discharge; or a scanty bleeding may be present. All the cases operated upon showed some pathological condition of the uterus or adnexa, fibroids and bilateral sclerotic and cystic ovaries predominating, which the author considers of important etiological significance. He mentions briefly the various theories advanced to explain this pain and concludes that it is due to an insufficient or abortive attempt at menstruation, the pain being a dysmenorrhœa due to degeneration and sclerosis of the ovaries and uterus.

Late Recurrence in Carcinoma of the Uterus.—The possibility of a late recurrence following operations for carcinoma of the uterus is shown by two cases reported by SEMON (*Med. Klinik*, 1910, vi, 1495). The first case was operated upon in 1900 for carcinoma of the cervix. Regular subsequent examinations covering a period of six years revealed no evidence of a recurrence. About two years later, pelvic pain and leucorrhœa developed, followed in about one year by a bloody vaginal discharge. On examination, a polypoid growth was found in the vagina together with a dense infiltration of the left paracolpium. Microscopic examination of the growth demonstrated carcinoma. This was probably a wound metastasis, although its lymphatic origin cannot be excluded. The second case had a superficial vaginal recurrence about five years after total extirpation of a myomatous uterus with very early carcinoma of the fundus. This recurrence, which showed an adenocarcinoma microscopically, probably resulted from inoculation at the time of the primary operation. These cases teach that patients should be kept under observation even longer than five years after operation. Beginning carcinoma in the fundus of a myomatous uterus can easily escape detection, since the distortion of the uterine cavity may render its position inaccessible to the curette. Should the clinical symptoms warrant a myomectomy rather than a hysterectomy, the uterine cavity should be carefully explored by palpation and curettage after removal of the tumor, to eliminate carcinoma.

DERMATOLOGY.

UNDER THE CHARGE OF

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Sarcomatosis Kaposi, with Special Reference to its Visceral Localizations.—**MARIANI** (*Archiv f. Dermat. u. Syph.* 1910, xcvi, Heft 2 and 3) reports three new cases of this very interesting affection, in one of which lesions similar to those upon the skin were found in the tonsils, œsophagus, the small intestine, and the colon. Histological examination of of these visceral lesions showed them to be essentially the same in structure as those upon the cutaneous surface. Inoculation of rabbits with particles of nodules taken from the skin shortly after death was practically without result. A study of these cases and of a large number of those found in literature leads Mariani to the following conclusions: Without doubt a certain predisposition, dependent upon race and climate, is present. No importance is to be attributed to chronic affections like syphilis, tuberculosis, functional and organic affections of the nervous system as causal factors, but certain chronic intoxications, such as alcoholism, are of importance in this relation. Certain general or circumscribed alterations of the vessels, such as arteriosclerosis, dilatation of the veins, tendency to hemorrhage, must be considered as predisposing elements. Chilling, trauma, cedemas of varying origin, and trophic disturbances of central origin must be regarded as occasional determining factors. Decided evidences of cachexia are observed in the acute or subacute cases (those running a course of one to three years) more frequently than is commonly supposed. The specific changes may affect not only the cutis, subcutis, and mucous membranes, but also the capsules and connective tissue of internal organs, periosteum, and bones. The blood does not share in any special manner in the disease; nor does the urine show any special changes. Treatment with arsenic has, in most cases, only a very transient effect; but it must be remembered that some authors have reported cases, observed for a long period of time, in which an actual cure has followed the use of this drug. The results of the x-rays are still doubtful. The author thinks the actual cause of the malady is probably a specific one.

A Peculiar Case of Keloid following Injections of Camphor Oil.—**BRAENDLE** (*Dermat. Zeitschrift*, 1910, xvi, Heft 12) reports the following interesting case of keloid: A woman who had received a number of injections of camphor oil in both arms and the right thigh during a severe attack of inflammation of the lungs, some three years later perceived at the points of injection hard nodules and cords in the skin

which gradually grew toward the surface and assumed a blue-red color. These lesions occasioned the patient no inconvenience except during changes in the weather, when she experienced drawing sensations. Although it was not possible to examine these nodules histologically, the author believes them to have been keloid. Braendle is likewise of the opinion that no real distinction exists between so-called spontaneous keloid and the traumatic variety, since both present practically the same picture clinically and histologically. The fact that after the extirpation of spontaneous keloid a scar keloid usually arises also speaks strongly in favor of the practical identity of the two varieties.

A Histological Study of Parapsoriasis.—VERROTTI (*Archiv f. Dermat. u. Syphilis*, 1910, xvi, Heft 2 and 3) reports some extremely interesting histological findings in a case which he regarded clinically as an example of the parapsoriasis of Brocq. The case was characterized by an eruption closely resembling psoriasis, but differing from this affection in some important particulars. Microscopic examination of sections made of the eruption showed multiple circumscribed foci in the cutis, composed of dilated capillaries with proliferating endothelium, lymphocytes, and epithelioid cells, the lymphocytes preponderating at the margins of the foci, and in some cases well-developed giant cells with peripheral nuclei. There was a tendency to necrosis of some of these foci and evidences of a sclerosing process, according to the age of the focus. There was also a perivascular infiltration of lymphocytes and epithelioid cells about all the vessels of the cutis with a periphlebitis in the deeper and middle portions. The alterations of the epidermis consisted of a parakeratosis of the infundibular portion of the hair follicles and of the papillæ with disseminated and circumscribed collections of leukocyte nuclei between the parakeratotic layers resembling that seen in psoriasis. Search for tubercle bacilli gave negative results. The author, on the ground of his histological findings, considers the case a psoriasiform, papulosquamous tuberculide.

Arsenical Keratosis and Arsenical Cancer.—DUBREUILH (*Annales d. dermat. et de syphilographie*, 1910, No. 3) reports 4 cases of keratosis following the long-continued administration of arsenic, in one of which epithelioma of the finger supervened. In all 4 cases the keratosis was of the circumscribed variety and affected the palms and soles, appearing as small corn-like elevations. In 3 of the 4 cases it had been taken for psoriasis, in the one in which epithelioma occurred for twenty years almost continuously. The author concludes his report of these cases with an account of his microscopic findings in the finger amputated for epithelioma. The microscopic changes consisted of circumscribed thickenings of the corneous layer, atrophy of the derma, and complex alterations in the papillary layer. In no instance did he find any relation between the epidermic alterations and the sweat ducts. [The subject of arsenical cancer is one of very great interest, and is deserving of much more attention on the part of the general pathologist than it has yet received. There can no longer be any doubt that the long-continued administration of arsenic, especially in considerable doses, may produce epithelioma of the skin.—M. B. H.]

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

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The Internal and External Secretion of the Organism in Health and Disease in the Light of Vital Staining.—GOLDMANN (*Verhandl. der Deut. Path. Gesell.*, 1910, 138) has made some remarkable studies of rats and mice that have received a vital stain prepared by Ehrlich and which is known as Isanammin blue. The stain is only effective when injected intravenously. Shortly after an injection the entire animal is stained blue, the same color is imparted to the aqueous humor and cerebrospinal fluid. A careful histological study of these blue animals has shown that only certain cells of the body are pigmented, and with the exception of the kidney where the cells of the tubuli contorti take a blue coloration, the pigmented cells are not those whose function it is to produce so-called external secretion, but rather the cells which may give rise to an internal secretion. In the liver only the Kupfer cells are pigmented; in the adrenal, aside from a few mesenchymal cells in the medulla, the cells of the zona glomerulosa and fasciculata; in the testicles the interstitial cells; in the ovary the granular cells of the follicle, and in the lung only a few mesenchymal cells about the blood-vessels and lymphatics. Neither the reticular cells lining the blood-vessel walls nor the red and white corpuscles are pigmented. The reticular cells of the lymph nodes take the blue stain. But richest in the blue cells is the subcutaneous connective tissue, the intermuscular tissue, the omentum, and the interstitial tissue of the intestinal tract. The blue cells in these regions are probably the "adventialzellen" of Marchand and the "wanderzellen" of Maximow. Under abnormal conditions the distribution of the pigment in an animal which has been vitally stained may vary. During pregnancy the animal becomes bleached, and an examination of the uterus and membranes shows an accumulation of pigmented cells in this region. A superficial wound is surrounded by an intensely stained zone. Section shows enormous numbers of blue mesenchymal cells surrounding and filling the granulating wound. Acute inflammation of the subcutaneous tissue and peritoneum is immediately followed by an accumulation of polymorphonuclear leukocytes and hyaline leukocytes, but later the inflammatory area is surrounded by blue cells which finally, after the destruction of the leukocytes, invade the necrotic mass. The study of tuberculosis in animals which are stained by Isanammin blue is of especial interest. In the liver the tubercles are surrounded by the blue cells as well as with plasma cells, which are readily differentiated, and with lymphocytes. The blue cells are the phagocytes, for tubercle bacilli may be discovered in their protoplasm. The Kupfer cells of the liver are not implicated in the process, but coincident with the accumulation of the blue cells about the tubercles in the liver, the cells of the same character which

under normal circumstances are so richly distributed along the lymphatics of the omentum disappear from this situation. The same thing occurs in necrosis of the liver produced by agents other than tubercle bacilli. Finally, about new growths the blue cells accumulate in great numbers. This method of studying experimentally induced lesions in the vitally stained animals has thus already thrown much light upon certain pathological processes and opens up a new and fertile field for investigation.

The Alterations of Metabolism and Pathology of the Blood in Chronic Lead Poisoning.—RAMBOUSEK (*Ztschr. f. exp. Path. u. Therap.*, 1910, vii, 686) has found that in rabbits which are poisoned by repeated doses of lead acetate there is a distinct alteration in nitrogen metabolism. This consists in an increase in the output of the total nitrogen. Since there are no alterations in the kidneys of rabbits suffering from lead poisoning, the increased secretion of nitrogen seems to be due to the direct influence of lead upon the metabolic processes. The results of these experiments correspond, therefore, to the clinical observations of Preti. Rambousek has found further that the red blood corpuscles from rabbits poisoned by lead acetate show a distinct decrease in resistance toward certain hemolytic agents, but not toward others. The three hemolytic agents employed were hypotonic salt solutions, saponin, and $\frac{1}{10}$ potassium hydroxide solution. Toward hypotonic salt solution there was no decrease in resistance of the red cells, but toward saponin and potassium hydroxide the decrease in resistance was marked.

HYGIENE AND PUBLIC HEALTH.

UNDER THE CHARGE OF

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Experimental Infection of Fowls with Anthrax by Feeding.—It has been generally recognized that birds are quite resistant to infection with anthrax, and that consequently there is but little or no danger of acquiring this infection by eating the flesh of these animals. HOFMEER (*Centbl. f. Bakteriologie*, 1910, iv, 434), after submitting this matter to an experimental inquiry, comes to the following conclusions: (1) In healthy, strong, adult fowls spontaneous infection with anthrax under ordinary conditions is exceedingly rare. (2) There is in birds no absolute immunity to anthrax. There is, however, an individual difference in their susceptibility to this infection. (3) Pigeons, ducks, and chickens may be infected with anthrax by way of the alimentary canal; pigeons more easily than ducks and chickens. (4) For artificial infection by way of the alimentary canal large amounts of the bacilli are necessary. (5) Inanition, other diseases, and youth are predisposing factors in this infection.

Tuberculosis Among the Indians.—LIPPS (*Jour. Outdoor Life*, September, 1910) tells what the Government is doing to limit the spread of tuberculosis among its Indian wards. The Indian Department and the Smithsonian Institution have been coöperating in this work. Five reservations have been studied and the percentage of tuberculosis has been found to vary from 11.8 among the Mojavas of Arizona to 24.5 among the Sioux. Dr. Hrdlicka advances the following statements, holding that tuberculosis is a new disease among the Indians: "The presence of tuberculosis in any of its varieties among the Indians before the advent of the Whites is doubtful. It would seem, on the one hand, a most improbable exception that an entire large race of people should be exempt from a disease so prevalent and universal as tuberculosis; yet the evidence we thus far possess points strongly to its former rarity, if not absence. There is a great scarcity of phthisis or other forms of infection among the Indians in early writers. (2) There is an absence of remedies and specialized forms of other treatment for the disease among the Indians. (3) We are confronted with the universal testimony of the old Indians, who declare that such a disease was not known among them, or was rare, before they came in contact with the whites; and with the marked freedom of the old men and women from tuberculosis of the glands and bones. (4) Whites who have been long in contact with the Indians all speak of the great increase of the disease within their memory, and observations of explorers and scientific men indicate its lesser frequency as we proceed backward into the past. (5) There is thus far an absence of lesions that would be ascribed to tuberculosis in the bones of the Indians proceeding from prehistoric burials. (6) The Indian manifests to this day less immunity toward the disease than the White, pointing to its later introduction or spread. In addition, it should be recalled that the former life of the Indian, with his clothing, food, exercise, and consequent higher physical tone, were all safeguards against the disease and would have minimized its frequency, had the tubercle bacillus been present in this soil."

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